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SPARK TELEGRAPHY.

Dr. Slaby, who has recently been making experiments under the patronage, and with the suggestions, of the German Emperor, has reached the conclusion that what we now call "wireless" telegraphy would better be named "spark" telegraphy. He seems to be right, inasmuch as no wireless system of telegraphy has yet been invented—that is, a wire of some kind or other is used in all the systems that have been described to date. At the same time, despite their differences in other regards, all of such systems use the electric spark to set up electrical oscillations, so that the term seems one that excellently fits its subject.

DISTORTIONLESS CIRCUITS.

The announcement that the American Telephone and Telegraph Company has purchased Dr. Pupin's patents for distortionless circuits for telephone purposes is not only of great interest, but probably marks the fact that telephony will take a long step forward in the new century. Without entering here into any discussion of how the extraordinary result has been accomplished, and assuming that it will be found in practice that practically distortionless circuits may be constructed, let us consider for a moment what this means to the art of telephony in general, and more particularly to some of its applications.

The possibility of telephoning through a transatlantic cable is perhaps the most striking feature of the promise of this new departure, but doubtless its greatest actual value will be found in the betterment of service on land lines—not necessarily long ones—and its application to high-speed machine telegraphy.

When it is considered that interest on the capital cost of a long line represents a considerable proportion of the charge now made for its use in conversation, it will be seen at once that any system permitting the construction of cheaper lines will reduce this cost, and hence extend telephone communication by cheapening it. There is, in commercial circles, a strong demand for long-distance telephone lines connecting certain important but widely-separated centres of industry. For instance, a line between New York and New Orleans would be kept busy for a large period of the year by cotton brokers and merchants, and a line from New York to San Francisco would certainly be of great value. Every extension of telephone service multiplies the value of that service in a geometrical ratio. Every new town connected to the general system by means of new branches of the long-distance service makes more valuable the system as installed in all the others. Even if no important lowering of cost of construction were to be expected as a result of the application of the new principles to telephone work, this fact of giving greater range and more widespread connection to the service would alone insure a considerable increase in its use and make it of more value to the community in general. When, however, it is considered that the system will probably involve a great cheapening in the cost of long-distance lines, permitting them to be built in large numbers and reducing the tolls charged for conversation over them, it will be seen that its value to the general public as a betterment of the telephone system is almost incalculable.

Whether or not we ever desire to hold spoken conversation with people on the other side of the Atlantic—desire it strongly enough to pay the high tolls that would necessarily be charged—we certainly do need to hold telegraphic communication with them. There are at present about fourteen cables across the Atlantic, each of which has an average maximum working capacity of 25 words per minute. The capacity of the total system, therefore, is not more than 350 words per minute. If it is possible to construct a cable that would permit telephony through it, the same cable will most easily carry Wheatstone or other automatic signals at the rate of 700 or more words per minute, so that one such cable would be equal to double the entire system now in operation under the Atlantic.

This statement is astonishing, but if one admits the possibility of transatlantic telephony its accuracy can not for a moment be doubted. Under the circum-

stances a few such cables would be able easily to take care of a vastly increased amount of business at greatly reduced prices. It is probable that a reduction of cable tolls, such as might easily be accomplished were circuits of this character laid down, would cause a totally disproportionate use of the cable as a method of communication. Despite the enormous advances in transportation that have been made during the past century, it still requires from 15 to 20 days to obtain an answer by mail from a correspondent in England, France, or Germany. The postal charges for a communication of this character are about 10 cents. A reply may be had by cable in a few hours, but at a cost of at least a hundred times as much. If cable tolls could be reduced until they were of the same order as ordinary telegraph tolls from place to place within our national limits, it seems unlikely that the enormous bulk of business correspondence going on between the two shores of the Atlantic would burden itself with the long delay incident to the mail in order to save the few cents demanded for toll. There opens up, then, before us, the possibility that the cable may at no distant date largely take the place of the mail steamer.

Important as is the improvement in telephony indicated by the new system, it is certainly no greater than that in telegraphy indicated above.

A LEGAL BARBARITY.

Early in the morning of January 14—just two weeks of the twentieth century having passed—a wretched creature named Neufeld was strapped in the electric chair at Sing Sing prison in the state of New York, thrown into coma by electric shocks, and fifteen minutes later was dissected by official surgeons appointed for that purpose. When the doctors finished with the flesh and bones and blood that had once been a man the man was unquestionably dead; when they began with the helpless body there is no certainty whatever that it was not alive and even possibly sentient. And this was the thirty-third such ghastly performance that has taken place in New York state since the infamous electrical execution law went into effect about seven years ago.

Does it not all sound like an echo from the dark ages? Most of us believe that capital punishment is still an unfortunate necessity; indeed this has been demonstrated by the experience of some communities which have abolished it. But cruel and barbarous executions are utterly repulsive to the feelings of civilized people. Electrical execution was suggested by a group of zealous reformers anxious to palliate the horrors of the scaffold and incidentally to gather some cheap notoriety. They drew a fearful picture of the sufferings of strangling victims of the gallows—and replaced them by the most ingenious tortures and a lingering death under the dissecting knife. They seized upon newspaper accounts of sudden deaths due to electricity and, because electricity was then a mysterious and much advertised thing, jumped to the conclusion that it would afford a merciful death to condemned criminals. But to make sure that an execution really executed they added a *post mortem* feature. Their charity stopped short; so long as the criminal did not scream and struggle under the knife it was all right. They filled him full of volts and let the surgeons do the rest.

Are we really a nation of hypocrites? Should we shudder at the malignity of the Chinese who carve and flay their living victims of the law, when perhaps we do the same thing? For, it must distinctly be understood that until every effort has been exhausted to resuscitate a man who has been shocked into coma in the electric chair there is no real evidence that he is dead. Indeed, from the accumulated experience of several years of working with high-tension currents, and the recovery of persons severely shocked and apparently dead, it seems safer to say that the electrified criminals are living when they go to the dissecting room.

Is it not time for this whole shameful business to stop? Can not public sentiment be enlisted to change a law that has substituted the scorching agony of the electric chair and the leisurely dismemberment of the probably living victim for the swift mercy of the noose? If we must kill criminals, let us put them out of their misery quickly and humanely—not with atrocities that would have sickened an officer of the Holy Inquisition. Shooting, garroting, hanging, the guillotine, harikari, beheading by the sword, are all humane compared with the unspeakable mutilations and sickening preparations for an electrical execution.

There are poisonous vapors that kill painlessly in a few seconds. Chloroform is merciful and certain; so are cyanogen, hydrocyanic acid and morphia. Can we carry into the brighter civilization of the new century the nameless barbarism of legal killings as now conducted in New York, and in the face of our knowledge of painless lethal methods? Do we dare to condemn the whipping-post when we legalize human vivisection?

AN INTERESTING ELECTRIC POWER INSTALLATION.

On other pages of this issue are illustrated and described at some length the fine plant of the Virginia Electrical Power and Development Company, at Richmond, Va. In many respects this installation deserves more than passing notice. It will use high-voltage incandescent lamps on its lighting circuits throughout; it will operate railway and lighting feeders from the same generators, or at least from the same busbars; it will do an extensive power-transmission business over a considerable district by direct currents alone; it will use either steam or water-power, or both, as occasion demands. The operation of such an installation can not fail to be of high interest and to develop a number of problems of a fascinating character. Especial interest attaches to the hydraulic work of this plant. Very extensive use of concrete has been made throughout, even the high chimneys being moulded of this material. As a whole the installation strikes the observer as a remarkably well worked-out example of intelligent utilization of the materials and forces at hand to produce the result desired—which is a definition of good engineering.

THE THEORY OF ALTERNATING DYNAMO-ELECTRIC MECHANISMS—XII.

BY W. ELWELL GOLDSBOROUGH.

If the electro-motive force impressed at the terminals of the condenser is a sine function of the time, expressed by the equation:—

$$e_c = E_c \sin \omega t, \qquad (131)$$

we can, by substitution, write equation (129) in the form:—

$$q = C E_c \sin \omega t \qquad (132)$$

$$= Q \sin \omega t, \qquad (133)$$

By differentiating equation (131) we find that:—

$$d q \div d t = C \omega E_c \cos \omega t, \quad (134)$$

and therefore the equation of the current flowing into the condenser is expressed by:—

$$i = C \omega E_c \cos \omega t \qquad (135)$$

$$= \frac{E_c}{\frac{1}{C \omega}} \sin (\omega t + 90°). \qquad (136)$$

the current is, therefore, 90° in *advance* of the harmonic electro-motive force impressed at its terminals.

Now suppose we have a circuit such as the one shown in Fig. 32, consisting of a non-inductive resistance (r) connected in series with a condenser (of capacity C), and that an alternating electro-motive force (e) is impressed upon the circuit. When the circuit is closed, and a state of uniform variation of the forces involved has been reached, it will be found that a variable current (i) is flowing in the circuit, but that its virtual value is less than the virtual value of the impressed electro-motive force divided by the ohmic resistance of the circuit owing to the reactive effect of the condenser.

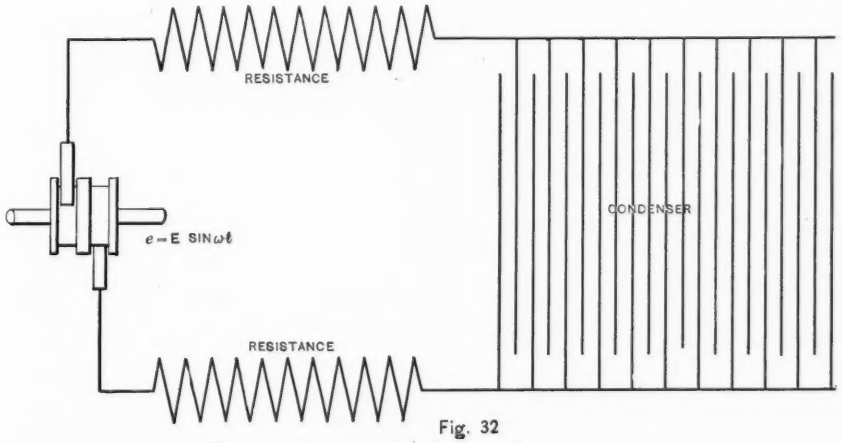


Fig. 32

FIG. 32.—ALTERNATING-CURRENT MECHANISMS.

By Ohm's law we know that it requires an effective electro-motive force having a virtual value,

$$\bar{E}_r = \bar{I} r,$$

to overcome the resistance of the circuit, and this electro-motive force is in phase with the current.

Furthermore, equation (136) shows that the current lags 90° behind an electro-motive force (e'_c) that is induced by the charge of electricity which is alternately given to, and removed from, the condenser plates as the current oscillates. When the current is a simple harmonic function the equation also shows that the reactive electro-motive force (e'_c) of the condenser, which the current induces, is also a harmonic function and has a virtual value equal to:—

$$E'_c = I \div C \omega. \qquad (137)$$

In order to set up a current through the circuit the impressed electro-motive force has to overcome the resistance of the circuit and the reactive effect of the condenser. It must, therefore, be the resultant of the ohmic electro-motive force and the electro-motive force which overcomes the reactive effect of the condenser. Each of these is a sine function when the current is a sine function, therefore, since as demonstrated on page 479, the resultant of two harmonics having the same frequency is a simple harmonic, the impressed electro-motive force will be a simple harmonic function of the time.

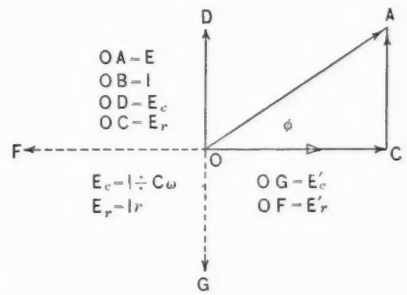


Fig. 33

FIG. 33.—ALTERNATING MECHANISMS.

The alternating electro-motive force that energizes circuits containing resistance and capacity may, therefore, be considered to be the resultant of two component electro-motive forces, one (e_r) that is in advance of it and overcomes the resistance of the circuit, and the other (e_c) that lags behind it and overcomes the reactive electro-motive force of the condenser. But the current is always in phase with e_r, therefore:

In circuits containing resistance and capacity the impressed electro-motive force and current are not in phase; the current is in advance of the impressed electro-motive force.

In Fig. 33 let OB = I, the maximum value attained by the current, then OC, which is in phase with I, and equals $I r = E_r$ is the maximum value of the component of the impressed electro-motive force which forces the current through the resistance of the circuit. The reactive electro-motive force of the condenser is 90° in advance of I and is represented by $OG = e'_{c_{max}} = E'_c$, therefore OD, which is equal and opposite to OG, equals the electro-motive force required to overcome the reactive electro-motive force of the condenser equals $e_{c_{max}} = E_c$, and since OG is 90° in advance of OB, E_c lags 90° behind the current I.

The resultant of OC and OD will be OA = E, the maximum value of the impressed electro-motive force,—

$$e = E \sin \omega t,$$

and as indicated by the figure,—

$$E = \sqrt{E^2_r + E^2_c} \qquad (138)$$

The angle AOC is the angle of advance of the current ahead of the impressed electro-motive force, and as the current is a sine function its value at any instant is expressed by the equation,—

$$i = I \sin (\omega t + \phi). \qquad (139)$$

Again, we have:—

$$i = \frac{d q}{d t} = C \frac{d e}{d t} c \qquad (130)$$

therefore:—

$$d e_c = \frac{I}{C} \sin (\omega t + \phi) d t \qquad (140)$$

and:—

$$e_c = \frac{I}{C \omega} \cos (\omega t + \phi) \qquad (141)$$

$$= \frac{I}{C \omega} \sin (\omega t + \phi - 90°). \qquad (142)$$

One of Chicago's electric lighting stations situated at Fourteenth street and Indiana avenue was recently abandoned and the 700 lights supplied by that station will be furnished with current from other power-houses.

Hydraulic and Steam-Power Plant of the Virginia Electrical Railway and Development Company, Richmond, Va.

The New Central Station for Supplying Railway Power and Lighting Current in Richmond, Va.—Elaborate Hydraulic Works in the James River Rapids—Steam Auxiliary Plant—Concrete Power-House.

The city of Richmond is built on a curve of the northern bank of the James River, the town of Manchester being on the opposite side of the stream. At this point the geological character of the country changes abruptly from the rock-ribbed hills of the Piedmont region to the alluvial plains that extend eastward to the sea, and, in consequence, while deep water exists up to the wharves in the eastern end of the city, the river descends for several miles opposite to and above the city in turbulent rapids through numerous channels separated by islands to reach the quieter water below.

For many years the water-power thus abundantly furnished has been partially utilized, canals at various levels having existed a long time; the highest level being the easternmost section of the old James River and Kanahwha Canal, which ran westward up the valley of the James and its tributaries and was designed to cross the mountains until it connected with streams tributary to the Ohio. It was never, however, completed west of the town of Buchanan, Va., about 180 miles west of Richmond. George Washington was one of the promoters of this enterprise and was the company's first president.

It was not until 1898, though, that any attempt was made to utilize fully the fine water-power running past the very doors of Richmond factories. It was then undertaken, and the company whose name appears in the title of this article was formed for the purpose of exploiting the water-power and distributing it electrically to the various industries in Richmond, as well as to the street-car lines of the city, and also to supply current for electric lighting. The plan of the work is exceedingly simple, though in carrying out its details many interesting problems were presented for solution by the engineers in charge. In brief, the system consists of a dam extending straight across the river, 1,700 feet in length (exclusive of the guard walls), at one end of which is taken off a canal about 2,200 feet long to a power-house in which turbines of the usual modern submerged type are installed, direct-coupled to the electric generators.

The dam has an average height of only five feet, with a maximum height of eight feet to the top of its masonry, and is seven and a half feet wide on top, the up-stream face being vertical and the down-stream face sloping with a batter of seven inches to the foot. It is constructed entirely of concrete, which, as is more fully shown below, is used almost exclusively for the construction of all the masonry work of the plant. On the top of this dam are timber sections intended to maintain the water level four feet above the masonry crest of the dam, and so arranged as to be lifted to pass floods. This arrangement is novel and highly interesting. The sections are 36 feet in length, the up-stream face of each being a portion of the convex surface of a cylinder about five feet wide. The sections are hinged above the flood-water level at the centre of the curvature of this face, so that each may be swung up to allow the flood waters to pass under it. The sections are made of heavy pine timber and planks faced with cotton duck laid on with several coatings of hot North Carolina tar. The apparatus for handling these sections consists of a long car or truck running on tracks laid on a permanent bridge which has been built above the dam high enough to clear the flood waters. Upon this truck is mounted an electric motor, both for its propulsion and for lifting the various sections of the crest. A trolley wire stretched above the bridge furnishes power for the truck, which can be rapidly run to any point and immediately connected with the gates, so that manual power is unnecessary in their operation. The guard wall of the canal is supplied with an unusually large amount of gateage, small sluice gates being so mounted in large frames that in low water, when it is important to save all losses of head, after the small gates are opened, the frames supporting them can also be lifted out of water. When this is done the waterway at the gates will consist of 10 openings, 12 feet wide and 9 feet deep, below the water surface.

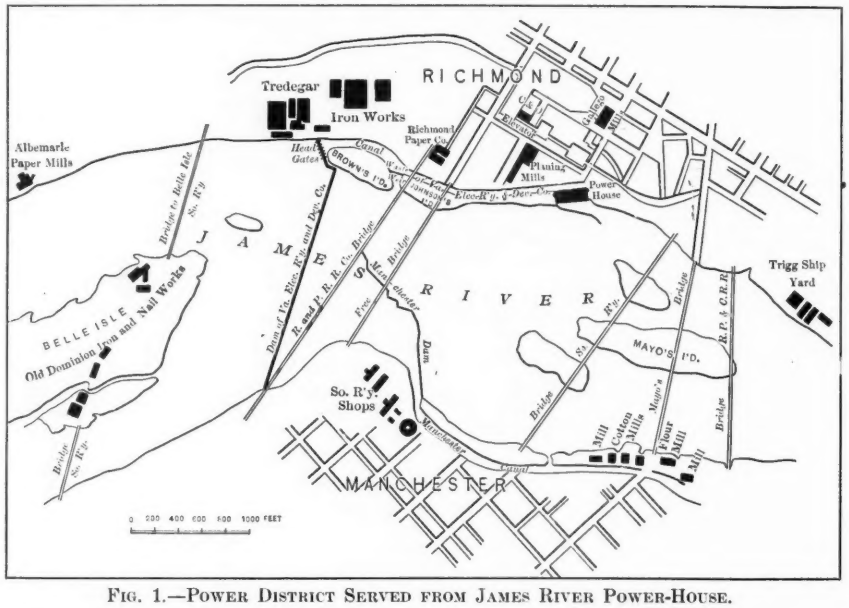


FIG. 1.—POWER DISTRICT SERVED FROM JAMES RIVER POWER-HOUSE.

From the northern, or Richmond, side of the dam extends the canal, which follows the course of the old Haxall Canal to the power-house. The first 900 feet after leaving the dam is simply enlarged by blasting out the hard bed-rock of the river bottom, and has a cross-section of about 1,200 square feet. The lower portion of the canal is lined with concrete and has a rectangular section, the depth of water being 13 feet and the width of the canal 50 feet. The concrete side walls are carried up three feet above the water level throughout this section.

The whole of the concrete was made

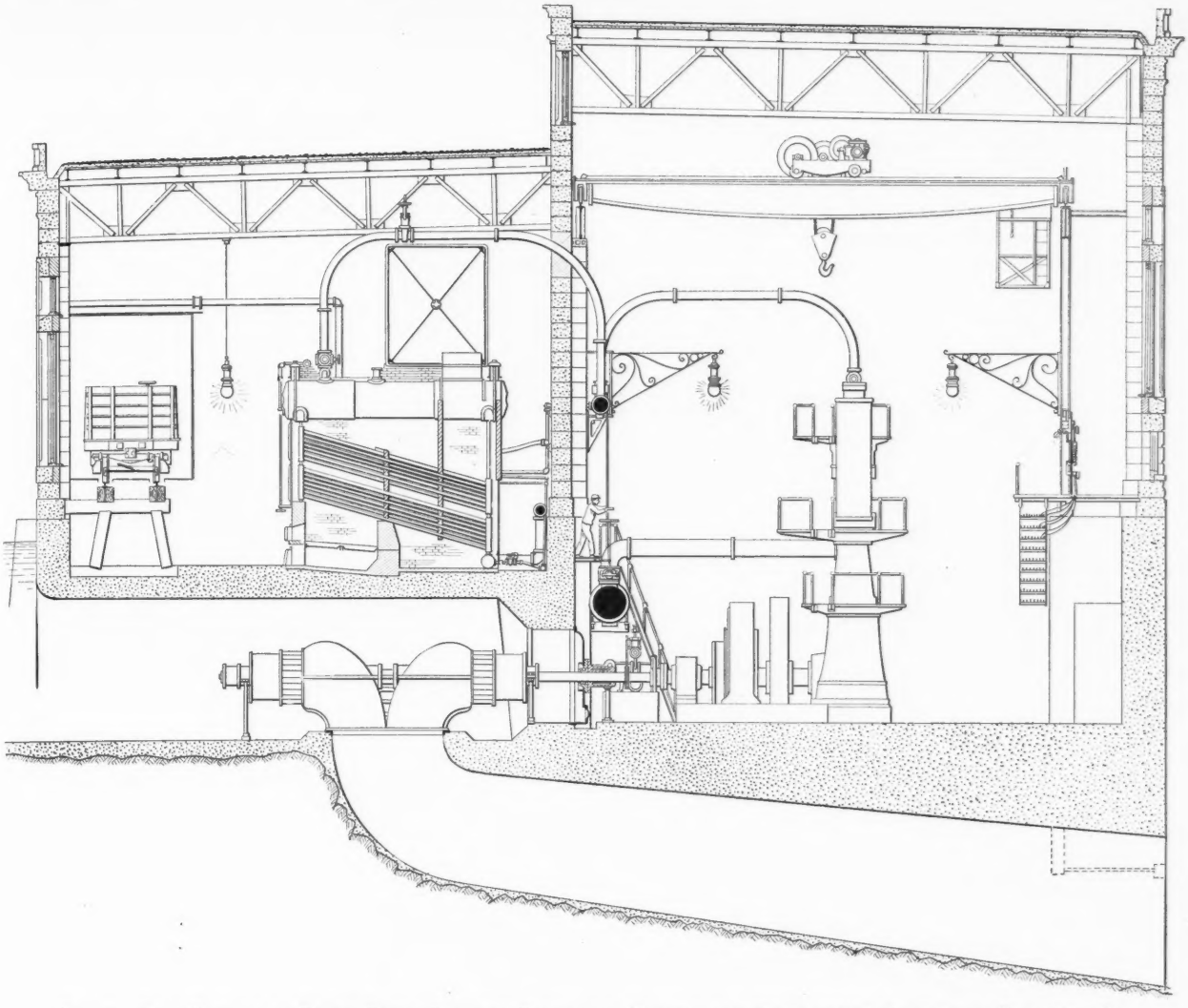


FIG. 2.—CROSS-SECTION OF POWER-HOUSE, VIRGINIA ELECTRICAL RAILWAY AND DEVELOPMENT COMPANY AT RICHMOND, VA.

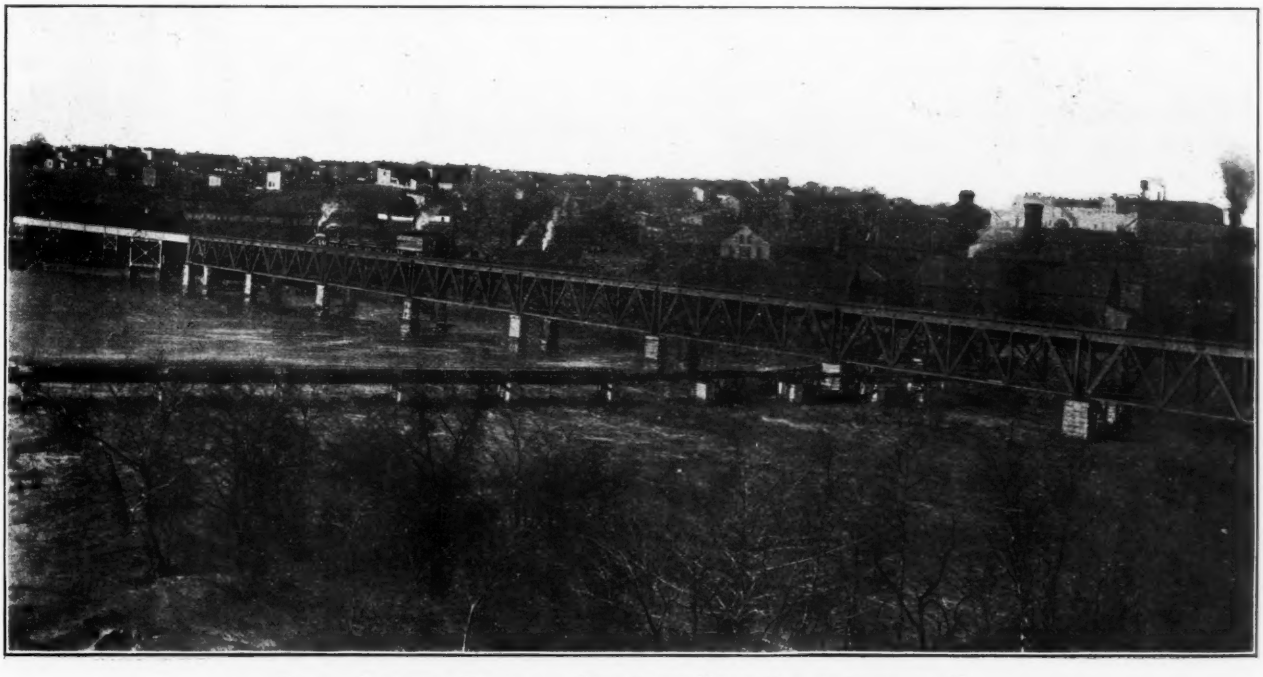


FIG. 3.—NORTHERN PORTION OF NEW POWER-HOUSE DAM AT RICHMOND, VA.

from the stone excavated from the site. This James River granite has for many years been considered an excellent building stone on account of its great hardness and closeness of grain, and it has proved an excellent material for the fabrication of the concrete. River sand is also found in abundance along the line of the work, but the fine screenings of the crushed granite have been found sharper and better adapted to the fabrication of concrete and were used along with the river sand. The majority of the concrete has been mixed by machine and delivered along the work in dump cars, drawn by mules.

The total available fall at the power-house is 25 feet. This structure is in several respects unique. The accompanying cross-section gives perhaps a better idea of it than can be had from a description.

The submerged chambers, in which the wheels are situated, are beneath the floor of the boiler room, and from the wheels draft tubes extend to the tail-race below. A complete auxiliary steam plant is a necessary feature of the installation, although it is not thought that it will be required more than one month in the twelve under normal ordinary conditions of operation with the present installation.

FIG. 4. VIEW OF PORTION OF DAM SITE.

The final equipment of the power-house will consist of eleven generating units, of which four are at present installed. These units consist of two 51-inch, cylinder-gate, horizontal-shaft turbines connected on the same shaft to a 750-kilowatt, direct-current, 550-volt, multipolar dynamo, a 76,000-pound flywheel, and a "steeple" tandem compound steam engine rated at 700 horse-power. The turbines are of the Stilwell-Bierce & Smith-Vaile Company's make, and are of the usual type, such as have been installed in numerous water-power plants lately described in the ELECTRICAL REVIEW. It may be mentioned here that the draft tubes, like nearly all the other fixed work in the power-house, are of concrete. Each water-wheel unit is controlled by a Lombard governor. Their shafts are direct-coupled with generator shafts through an ordinary bolted coupling which can be released in about 15 minutes should this become necessary, or should it be desired to drive the dynamo by the engine alone. The engines are detached by uncoupling the connecting rod from the crank pin.

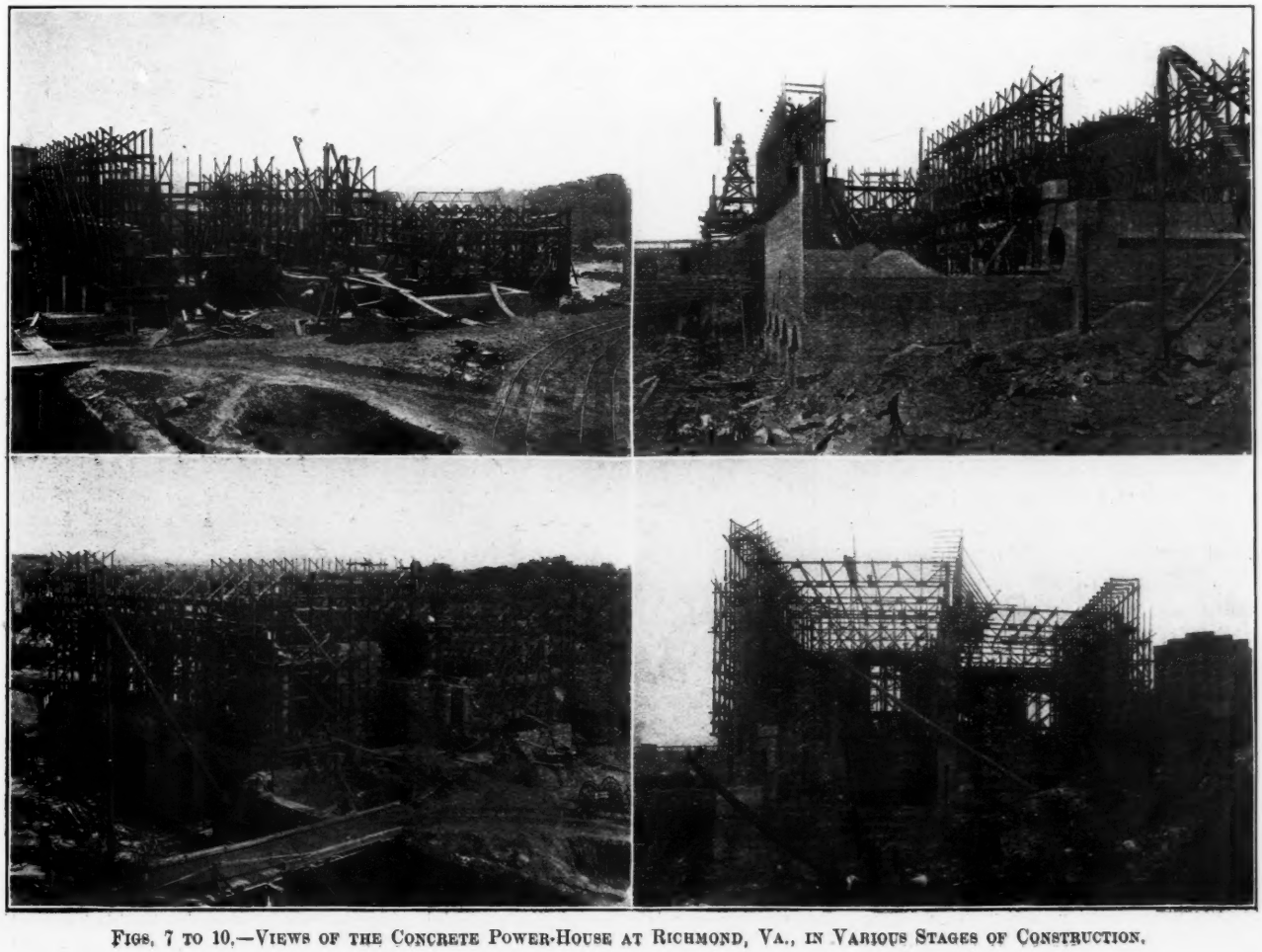
FIG. 5.—MAKING THE FOUNDATIONS AT THE RICHMOND POWER-HOUSE—SHOWING TRANSPORTER DELIVERING LOAD OF CONCRETE.

The generators are of the well-known General Electric railway type, having 12 poles, and are rated at 750 kilowatts each. They furnish 550 volts direct-current at no load, and are over-compounded to give 580 volts at full load. The heavy fly-wheel mentioned above is mounted between the generator bearings, and runs therefore with the water-wheels as well as with the engines.

FIG. 6.—TEMPORARY OVERHEAD CRANE USED IN SETTING CONCRETE ASHLARS IN WALLS OF JAMES RIVER POWER-HOUSE, RICHMOND, VA.

The engines were manufactured by the Edward P. Allis Company, Milwaukee, and are of a vertical type. The design is that known as the "steeple tandem," the high-pressure cylinder being placed on top of the low-pressure cylinder, while the valve gearing is accessible from galleries built around the middle height of the engine. These machines are rated to give their best economy when working at 700 horse-power, and are able to work up to an ultimate maximum of 1,500 horse-power each. The engines are fed with steam from a header that runs along the engine-room side of the heavy concrete wall separating the boiler room from the engine room, and exhaust into an exhaust header going out to a pair of Worthington siphon jet condensers situated on the outside of the building near the base of the stack. Provision is also made for free exhaust. The condensing water is, of course, taken from the canal, and the boiler feed pumps also draw from the canal, although connections have been made with the city water supply system to meet emergencies.

The boiler room is so arranged that cars of coal can be run in on a trestle elevated some nine feet above the floor and



FIGS. 7 TO 10.—VIEWS OF THE CONCRETE POWER-HOUSE AT RICHMOND, VA., IN VARIOUS STAGES OF CONSTRUCTION.

their contents dumped in front of the boilers, a passageway sufficiently large for the stokers to work in being left between the coal pile and the fronts of the boilers. The total storage space available for coal is about 10,000 cubic feet. Hand stoking will be used, as labor is cheap and the steam plant will be in operation so little. The boilers are of the Babcock & Wilcox water-tube type, the present installation comprising two double batteries, each having six 42-inch steam drums, and each rated at 1,000 horse-power. A pressure of 150 pounds will be carried at the boilers.

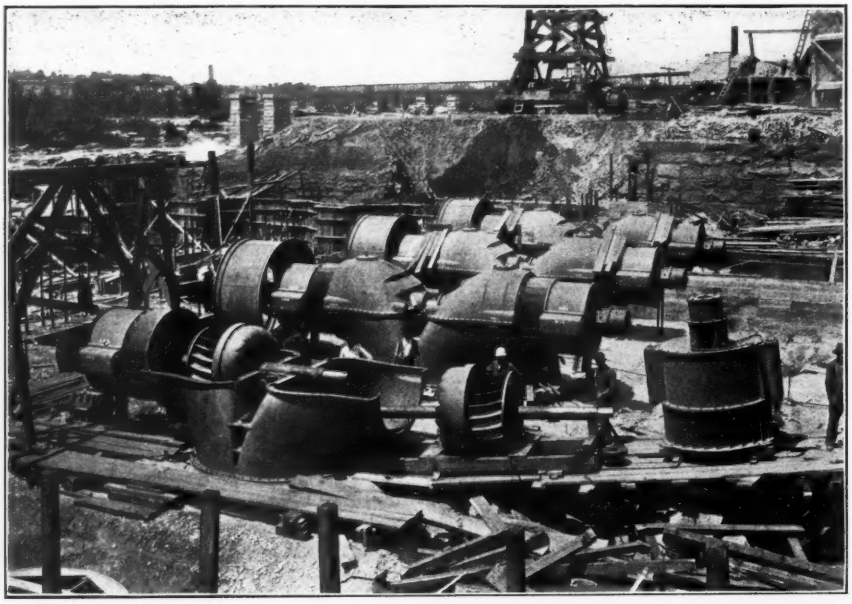


FIG. 11.—GROUP OF TURBINES IN PLACE BEFORE ERECTION OF POWER-HOUSE.

The power-house building itself is a remarkable structure, in that it is entirely constructed of concrete, steel beams, tile, and other fireproof material. The walls, including the partition walls, were not made in the usual way that has been so much in vogue lately, wherein the walls are solid monoliths made in moulds, but they were constructed of blocks of Portland cement concrete, each moulded to the desired shape and the whole laid together as stone ashlars usually are, Rosendale cement mortar being used for pointing the joints. Some attempt was made at architectural beauty in the design of the building, as may readily be seen from the accompanying engravings made from photographs of the various stages of the work. At present only one stack is erected. This stack is octagonal outside—the outer shell above the roof level being of monolithic concrete—the flue, which is of common brick except about 25 feet at the bottom which is lined with fire brick, is 11 feet in diameter. The stack is 175 feet high. For constructing the outer shell wooden forms were built covering the entire outside, the inside form being removed as the brick work of the flue was brought up and in this the concrete is rammed, the material being sent up on a steam lift in buckets from the mixing board at the base of the stack, the same lift serving also for sending up the bricks.

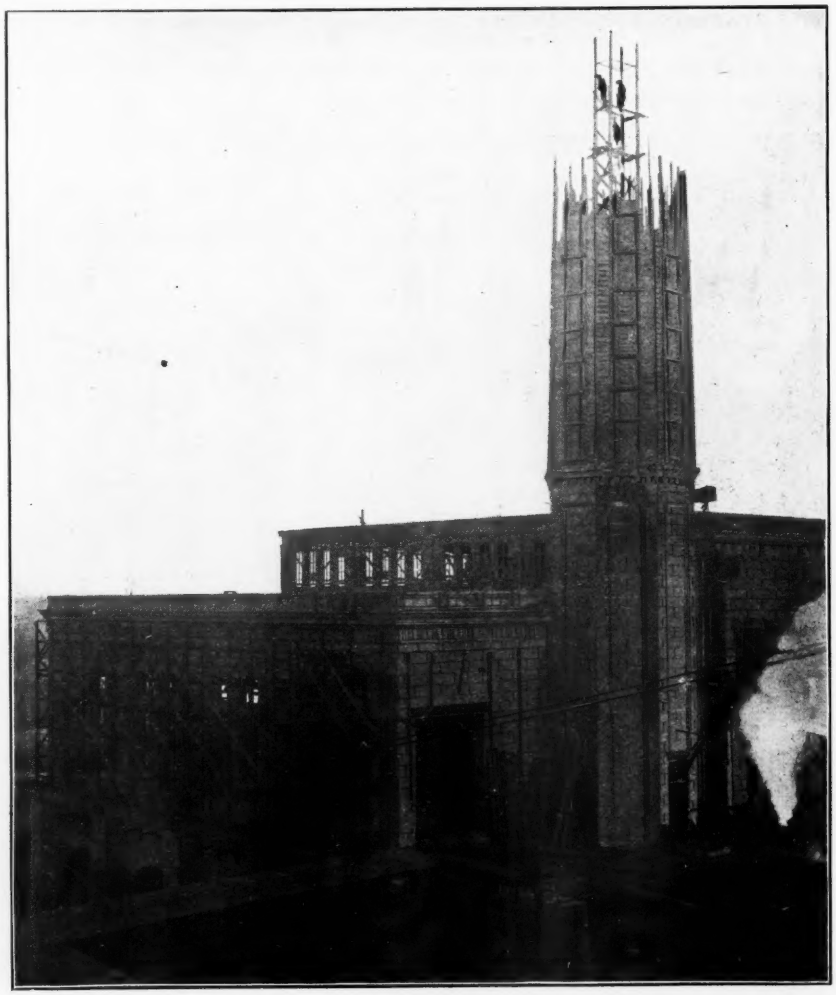


FIG. 12.—SHOWING METHOD OF WORK ON CONCRETE CHIMNEYS, JAMES RIVER POWER-HOUSE, RICHMOND, VA.

For the distribution of light and power, a 235-470-volt, three-wire system was adopted and to make use of the 550-volt generators on the lighting load, two 100-kilowatt balancer sets were installed. These were built by the General Electric Company and consist of two 50-kilowatt 250-volt machines rigidly coupled together, giving a neutral wire balancing current of 400 amperes at normal load and 580 amperes at 40 per cent overload.

For equalizing the voltage of the different feeders at time of maximum load, a three-unit booster set was purchased from the General Electric Company. The boosters are designated as multipolar 6-20-550, being six-pole machines of 20 kilowatts each and running at 550 revolutions, having a full load current capacity of 1,000 amperes at 20 volts. Carbon brushes are used on these as on all other apparatus in the station. The motor driving the two boosters is classified as multipolar 4-65-550, being a four-pole machine

of 65 horse-power, running at 550 revolutions, with an initial voltage varying from 470-540 volts.

FIG. 13.—SHOWING PORTION OF FINISHED CONCRETE WALLS ON CANAL.

voltages, having two high and two low bus-bars and one common neutral bus, and the positive and negative bus-bars for the railroad work. The high and low bus-bars for lighting and power are placed underneath the switchboard gallery and are supported by angle irons bolted to the wall of the building. The railroad bus-bars are the standard construction of the General Electric Company.

The switchboard consists of nine railroad feeder panels, one wattmeter panel for the railway service, 10 generator panels, one booster panel, two balancer panels, one wattmeter panel, with wattmeters and ammeters on both the high and low bus, and nine feeder panels for light and power. The above panels have necessary switches, instruments, etc., for the control of the different machines and feeders.

Starting from the station, an underground system was put in. The ducts are of the well-known Jno. T. McRoy make, being four and six-duct conduits of six feet lengths, and are laid in sections of 64 ducts, 36 ducts, 24 ducts, 16 ducts, 12 ducts and 10 ducts, starting from the 64 ducts at the station and decreasing in size to the furthest manhole.

The three underground feeders are cables, manufactured and installed by the Jno. A. Roebling's Sons Company, and are

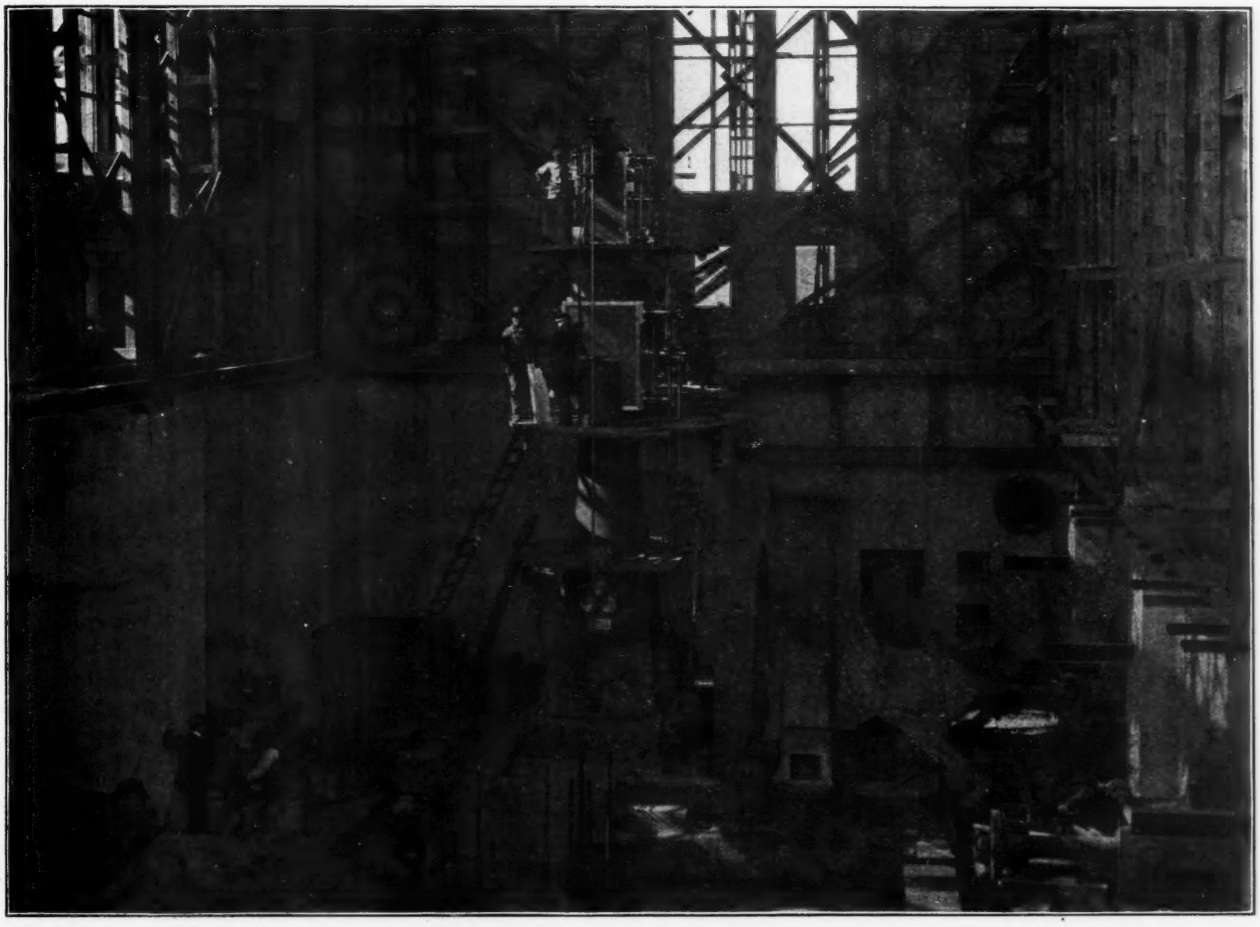


FIG. 14.—ONE OF THE VERTICAL ENGINE AND GENERATOR UNITS IN THE RICHMOND, VA., POWER-HOUSE.

For the control of the different voltages, a black marbleized slate switchboard was purchased of the General Electric Company, and was built for three different

rubber covered, lead encased, and range in size from 250,000 circular mils to 600,000 circular mils and a length for all feeders of 25,000 feet.

The underground mains are Edison tubes having a length of about 70,000 feet.

The five overhead feeders range in size from 250,000 to 500,000 circular mils, with a length of 50,000 feet, two of these are feeders for the underground system. The overhead mains having a length of 30,000 feet range from No. 4 B. & S. gauge to 250,000 circular mils and are connected into the underground at three different points.

A large number of industries in Richmond will be supplied with power from this plant, among them the large Richmond Locomotive and Machine Works, and the W. R. Trigg Ship Building Company's yards, at which a number of torpedo boats and small cruisers for the United States Government are now under construction. The railway system of the Richmond Traction Company will also derive its current from this power plant.

The work of construction has been in the hands of the James River Construction Company, which occupies the usual construction company relation to the main enterprise. The hydraulic design is due to Mr. Reuben Shirreffs, while much of the steam and electrical design is due to Mr. E. J. Willis, who was formerly one of the company's engineers. Mr. J. P. Pope, formerly in charge of the New Orleans Edison Electric Company, is now superintendent, and in charge of the electrical and steam departments. Mr. Frederick Sargent was consulting steam and electrical engineer during the original design of the plant. Mr. E. L. Bemiss is president of the development company and Mr. R. Lancaster Williams of the construction company. The enterprise was financed by Messrs. Jno. L. Williams & Sons, of Richmond, and Messrs. Middendorf & Oliver, of Baltimore. To Mr. Fred J. Todd, of Baltimore, is due the credit of initiating and working up the project.

Platinum.

The uses to which platinum is put are very multifarious. It is employed to-day in the electric incandescent lamp as a fine wire for conveying the electric current through the glass walls of the bulb to the light-giving carbon filament within; in telegraph, telephone and other electric apparatus for non-corroding contact points; in warfare, in the form of fine wires for exploding torpedoes and submarine mines; in pyrometers, for the measurement of the temperature of blast-furnaces and for determining the fusing point of other metals; in the X-ray tube, as leading-in wires and as a source of excitation of the X-rays, and in photography, in the production of platinotypes noted for the artistic effects produced and the permanency of prints attained. These are but a few of the many applications of this metal and its salts, says *Engineering*, but enough are enumerated to illustrate its wide and varied applications. It is of some significance that the world depends for about 95 per cent of its annual supply upon Russia alone, and were that country to fail us, the position would be serious. Happily, Russia's output has increased steadily, and has just about kept pace with the enhanced demand. For last year the total was 13,242 pounds, a growth of more than 100 per cent since 1890, when the figure was 6,363 pounds. What is more, there is no reason to suppose that the deposits are becoming attenuated; on the contrary, the good prices obtained have led to the exploitation of virgin ground in those districts which have been associated with the metal for over three-quarters of a century. They are situated in the Ural Mountains, in the Government of Perm; and, as proof of our remark about the opening of fresh ground, it may be stated that in the one district of Goroblagodat there are now over 100 allotments as compared with about 70 only five years ago.

The metal is obtained from alluvial deposits, or platinum-bearing sands, which frequently include gold, and which vary in occurrence up to four or five zolotniks (the zolotnik equals 66 grains troy) and more in 100 poods of sand (3,610 pounds). The thickness of the beds ranges from three to seven feet. The grains of metal are small in size, but sometimes nuggets weighing a kilogramme or more are unearthed. The platinum is often accompanied by other rare metals, such as iridium and osmium. It is sent to St. Petersburg in the crude state, and, although there are refineries in that city, very little is dealt with there, and as the demand for the metal is almost entirely from abroad the bulk is exported as it is received from the mines. The deposits were discovered in 1819, but were not worked on a commercial scale until 1824, when some rich veins were opened in the Nizhni-Tagilsk district. From 1828 to 1845 platinum money was coined, and, in consequence of this demand, the production increased steadily until in 1845 it reached 3,800 pounds. When the metal ceased to be employed for purposes of coinage, the production fell off almost to nothing. About 1860, however, there was a revival caused by the growth of a foreign demand. Since then the increase has been appreciable—in 1875 the output was 106 poods; in 1880, 129 poods; in 1885, 188 poods; in 1890, 200 poods, and in 1895, 233 poods, equal to 8,411 pounds. The most productive of the deposits now worked are still those of Nizhni-Tagilsk, belonging to Prince Demid, of San Donato, but the mines of Krestovozdvighensk make a good second. Nearly the whole of the annual production comes to the United Kingdom, the German takings, which were in excess of our own in 1884, having gradually fallen since then to only about 900 pounds in a year.

Outside Russia the most promising sources of platinum production are New South Wales and the United States, although a little comes from the Republic of Columbia, and the metal is known to exist also in Mexico. In New South Wales it has been found on the northern beaches in the vicinity of Byron Bay, as well as at Broken Hill, in the far west of the colony, and recently in connection with the auriferous alluvial deposits at Burra-Burra, Fifield and Platina, localities which are situated about 60 miles west of Parkes, on or near the Melrose Plains. Mining operations have of late been confined to Fifield, the yield for 1898 being 1,250 ounces, valued at £2,062. The miners working for gold obtain the metal in the auriferous wash-dirt. This figure is 716 ounces less than the quantity won during 1897, the drought being responsible for the decrease. Beach mining in the Ballina district, where platinum was found associated with the gold in considerable quantity, is now a thing of the past. A special lease of abandoned ground at Macaulay's Lead, Jerusalem Creek, has been applied for, the intention of the applicants being to try the ground by the cyanide process. Should this prove successful the output of platinum will be largely increased, as an effort will be made to save any of the metal met with in the concentrates.

In regard to platinum in North America, Mr. D. T. Day told us recently (Transactions of the American Institute of Mining Engineers) of his examination of the various places on that continent where it has been reported to exist. He stated that the only localities where the metal occurs otherwise than as a mineral curiosity are in California, Oregon and British Columbia. On the coast of the Pacific many beach deposits are known, but Mr. Day's experience of them is that the platinum is discouragingly fine, and difficult to save. "Most of the platinum product has come from inland diggings, where the grains are coarser, particularly the placers of the American River, and in Plumas, Shasta, Trinity and Siskiyou counties, California. The latter confirm the accepted idea that the platinum originates in the serpentine rock in which the region abounds, for the platinum-bearing gravels are sure to be closely associated with some prominent serpentine ridge. Osmiridium seems to constitute the greater part of the 'metal' found, even to the extent of 90 per cent." Mr. Day gave the pan tests of a large number of platinum-bearing gold sands in California and Oregon, and the percentages of platinum and of the "other platinum metals" (iridium, osmium, ruthenium, rhodium and palladium) in other samples. In these the value of the platinum metals ranges from *nil* to $1,934 per ton, containing generally less platinum than gold, but occasionally more, even up to three times the quantity. There is room for hope that America will supplement the available quantity to some extent, but for the present the main dependence of consumers must be upon Russia.

Death of Frederick A. Gilbert.

Frederick A. Gilbert, president of the Boston Electric Light Company, died of apoplexy while dining with friends at the New York Club, New York city, on the evening of January 18. Although several physicians were called at once, Mr. Gilbert expired before their arrival. He was visiting New York on business in connection with the proposed combination of the Boston Electric Light Company and the Edison Electric Illuminating Company of Boston.

Mr. Gilbert was 54 years old and had been connected with the company, of which he was president, since its inception. He first became identified with the electric light companies in Boston in 1888 through the purchase of the Merchants' Electric Light Company, at foreclosure sale. He succeeded in successfully building up that company, and a few years later consolidated the Brush and Citizens' Electric Light companies, establishing the present Boston Electric Light Company. Mr. Gilbert has been the only president of the Boston Electric Light Company, owning at the time of his death 1,000 shares of its stock. He was prominent in electric lighting circles, having entered the central-station business nearly 20 years ago in New Haven, Ct. He was one of the earliest members of the National Electric Light Association, and had always been prominent in its deliberations. He was also president of the Massachusetts Electric Lighting Association. He had made several improvements in enclosed arc lamps, the patents for which he sold some years ago to the General Electric Company.

Mr. Gilbert was a man of considerable wealth, his fortune being estimated at $500,000. Mr. Gilbert was also either president, an officer or large stockholder in the New Haven, Bridgeport, Newport and Portland electric light companies. He was a director in the New England Electric Vehicle Transportation Company and the Copper Range Railroad. During the past few years he has been quite heavily interested in copper mining. He left no will. He had a wide circle of friends and acquaintances, all of whom will be shocked to hear of his sudden death. He leaves a widow and three children. The funeral, which was largely attended by his friends and business associates, was held at New Haven, Ct., on January 21.

OBITUARY.

A. H. Seymour, a telegraph operator, died of the grip, on January 17, at his home in Williamsburgh, Brooklyn, N. Y. He was born in Manlius, N. Y., 65 years ago and learned telegraphy at the age of 15. He was the first sound operator in Milwaukee, and 20 years ago was the chief operator for the Western Union Telegraph Company.

John Clifford Brown, of New York city, who served during the Spanish War as a captain in the Eighth New York Volunteers and afterward enlisted as a private in the Engineer Corps of the regular army, died on January 16, at Los Angeles, Cal. Captain Brown was 29 years old, was a graduate of the class of '93 at the Massachusetts Institute of Technology, Boston, and had served for several years on the engineering staff of the New York Telephone Company. His mother, Mrs. Philip Henry Brown, a wealthy widow of Portland, Me., recently died at Los Angeles, where she went to meet her son on his arrival from the Philippines.

FREDERICK A GILBERT.

Edwin Holmes, president of the Holmes Electric Protective Company, of New York city, died at his home in New York, on January 17, of a complication of diseases. He was 81 years old, and was born in West Boylston, Mass. He began the study of electricity in 1857 and two years later secured a patent for an electrical appliance called the "home protector." This apparatus consisted of a system of wires connected with a bell which would announce the opening of a door or window in a house, once the alarm had been set. This was probably one of the earliest forms of burglar alarm. Mr. Holmes came to New York and became interested in the development of the telephone, becoming president of the first telephone company in the city, now known as the New York Telephone Company. In 1873 Mr. Holmes conceived the idea of furnishing burglar and fire-alarm protection by electrical apparatus to the banking-houses and jewelry firms in the Maiden lane district. He established a central station in Pine street equipped with his system. The Holmes Electric Protective Company was formed in 1883. Of late years his son, Mr. Edwin T. Holmes, has been the practical head of the company.

The New England Lighting Situation.

President Burdett, of the Boston, Mass., Electric Light Company, is reported to have said in a recent interview: "The death of President Gilbert will in no way affect the policy of the company. The Morgan proposition for a lease of our property is considered as practically a dead issue. Our directors have not, and probably will not, for the present, consider any proposition for a lease of the company."

An Electricity Supply Station for Amsterdam.

United States Consul Frank D. Hill writes from Amsterdam, Holland, as follows:

The city council of Amsterdam has voted 6,000,000 guilders ($2,412,000) for an electric plant which is to furnish power for street cars, lighting, etc., in the city. It is gratifying to state that prospects seem fair for part at least of the supplies required to come from the United States. The establishment of the plant will mark an epoch in Amsterdam's progress, and the sum voted is large enough to provoke zeal in attempting to secure the work.

Municipal Inspection and Installation.

Mr. F. C. Mason, superintendent of police telegraph of Brooklyn, N. Y., has received a large number of requests from mayors and officials of many cities for copies of his recent paper entitled "The Progress and Needs of the Fire and Police Departments from an Electrical Standpoint," as well as for rules governing municipal inspection and installation. At the next meeting of the International Association of Municipal Electricians, to be held at Niagara Falls, in September, 1901, these subjects will be the principal topic for discussion. A committee has been appointed to prepare the matter for discussion and Mr. Mason requests all the municipal electricians or other city officials having a code of rules governing their work to forward copies to him so that the committee may have abundant material to select from.

Electric Railways

Rapid progress is being made on the electric line between Parkersburg, W. Va., and Williamstown, the line having been nearly half completed.

A financial journal states that the New York Central Railroad Company, on the authority of a Boston & Albany official, will expend not less than $2,500,000 in the development of the former company's harbor property as soon as the necessary arrangements can be made for floating the bonds.

From present indications the proposed building of the Indianapolis Power Plant Company will be erected in the near future; $200,000 worth of stock has been pledged, but not $30,000 has been subscribed. In spite of this fact, however, it is believed that matters will be so arranged within a short time that the proposal will become a fact.

The common council committee of Minneapolis, Minn., has finally settled an old controversy by recommending an extension of the Oak street line which will be extended three blocks farther than it is at present, terminating at Fulton and Oak streets, southeast. This will materially better the street car service and be of considerable advantage to the patrons of the line.

No delays will be experienced in rebuilding the Ridgewood power-house of the Brooklyn Rapid Transit Company, and arrangements have been made with the Edison Electric Light Company and the Coney Island Railroad Company to supply power until the other power-houses of the line have permanent connection established with the wires which supply the lines of cars that obtain their power from the burned station.

The Elgin City, Carpenterville & Aurora Street Railway, of Illinois, was sold on December 10 to a Cleveland syndicate of railroad promoters for $550,000, which figures out to about $110 a share. To prevent any chance of the deal falling through a substantial payment was made by the purchasers and an effort will be made to secure the right to build through Batavia and Geneva and enter Aurora over the tracks of the new Aurora, Wheaton & Chicago Railroad.

A Colorado judge has decided that an electric street tramway is not a railroad, and that therefore it must pay taxes as assessed by the county and not by the state board. The electric line contends that it is a railroad since it is incorporated under railroad statutes for 50 years as steam roads are, and the reply of the court is that it is not, being merely a street tramway system. Considerable space has been devoted to the matter in local papers and it is believed that the tramway company will fight the matter to the end.

A meeting of the common council held in Richmond, Va., voted recently for more cars on Main street and the report containing the information stated that such a demonstration of public feeling as was manifested on that occasion was never before seen in a Richmond council chamber. The session of the council which passed the ordinance lasted from early in the evening until two o'clock in the morning, and even at that hour people were jammed in the corridors, windows, transoms and doors of the building, having remained there to await the decision for six hours.

City Ownership of Street Cars in Liege, Belgium.

Alfred A. Winslow, United States consul at Liege, Belgium, writes as follows regarding municipal ownership of electric tramways in that city:

The question of municipal control and ownership of street-car lines, gas and electric lighting and waterworks plants has been seriously occupying the attention of the officials of this province for the past few years, with the result that the city of Liege has taken charge of three of the street-car lines and has in contemplation the purchase of the above-mentioned plants on the expiration of their franchises if the present undertaking meets with the expected success.

The franchises (for 28 years and 11 months) of the three lines owned and operated by the Société Anonyme Tramways Liègeois, in the city of Liege (in all 11.9 kilometres, or about 7.4 miles), expired December 1, 1900, and the city purchased them, together with the rolling stock and equipments, for a sum of 1,200,000 francs ($231,600), and has leased them for ten years and one month to De Mellotte & Company, under very rigid regulations. This company is composed of the employés of the old company, with a capital of 170,000 francs ($38,810), divided into 1,700 shares of 100 francs ($19.30) each.

This company is to pay a rental of not less than 300,000 francs ($57,900) per year on a gross earning of 800,000 francs ($154,400) or less, and an increase of one per cent additional on the gross receipts every time these increase 50,000 francs ($9,650); thus, should the gross receipts reach 900,000 francs ($173,700), the amount to be received by the city would be 300,000 francs plus two per cent of the 900,000 francs, or 18,000 francs—a total of 318,000 francs ($61,372)—and so on.

The city is to provide all new equipment, side tracks, extensions, etc., and is to be the sole judge of what is needed. It is to have a general supervision of the running of the line. The books of the company are to be open at any time to a properly authorized representative of the city.

The lessees are to make all repairs of the line and rolling stock, and to keep the roadway between the tracks and for 19 inches on either side in good repair, and to pay all damages resulting from accidents.

There are at present employed on these lines 30 motor cars and 13 trailers, and, owing to the great reduction of fares, this equipment will doubtless be insufficient. The cars run every six minutes between the hours of 8.30 A. M. and 8.30 P. M., and at least every 15 minutes the balance of the time from 7 A. M. to 10 P. M. in Winter and from 6.30 A. M. to 11 P. M. in the Summer. The usual speed is 10 kilometres (6.2 miles) per hour, with a maximum speed of 12 kilometres (7.4 miles) per hour.

The fare charged by the old company was, for first class, 10 centimes (2 cents) for the first kilometre (1,093.6 yards) and 5 centimes (1 cent) for each additional kilometre, with maximum charge for single trip of 20 centimes (4 cents); while for second class the charges were 8, 4 and 16 centimes, respectively. The new fare to be charged is 10 centimes (2 cents) for any single trip, with double fare after 11 o'clock P. M. There will be no second class.

There were employed by the old company 205 persons who were paid from 3 francs (57.9 cents) to 5.50 francs ($1.06). Under the new management there will be at least as many persons employed, and the city has made it obligatory upon the company to pay its motormen and conductors not less than 45 centimes (8.7 cents) per hour for a day of nine hours, and 55 centimes (11 cents) for all overtime. The conductors and motormen must be given one holiday every two weeks at full pay.

The new company also pays 20,000 francs ($3,860) per year for the advertising privileges in the cars and about the stations of the lines.

A Novel Method of Operating Arc Dynamos.

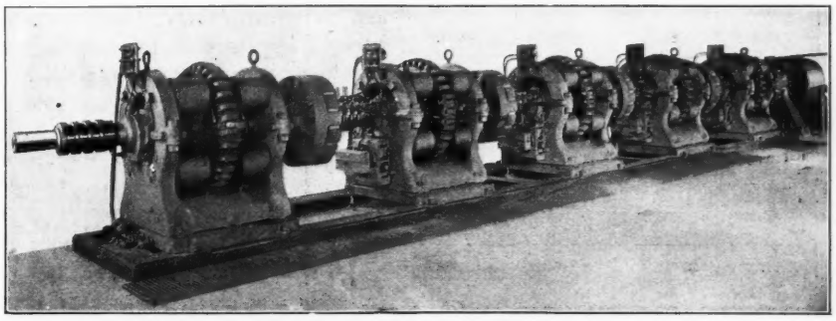
The problem of operating arc dynamos connected together at the shafts and driven from a pulley at one end—the pulley in this way operating three, four or five machines—has been frequently discussed by engineers, but nothing has hitherto come of it because it was considered necessary to provide means, by the use of clutch couplings, hollow shafts, etc., of disconnecting any one of the dynamos without interfering with the operation of any of the others. As an arrangement of this kind would be delicate, complicated and very expensive, the idea was abandoned.

Mr. Ellicott, city electrician of Chicago, however, found it necessary to solve such a problem, because of the peculiar conditions in the Waller station, at Englewood, where the building was about 30 feet wide and 125 feet long. To install arc dynamos in the usual way would fill the room with jack shafts and belting. Mr. Ellicott, finding that in three years none of the eleven large dynamos in service has been shut down, determined to risk running several dynamos on a single shaft. Mr. Ellicott's installation consisted of five No. 13 Brush arc dynamos, coupled together at the shaft ends by the use of rubber buffer couplings. The only provision made for the cutting out of a particular dynamo in case of trouble was by shutting down the whole line, lifting the top part of the fields off, and lifting out the armature and putting in its place a piece of shafting for the purpose of completing the connection between the dynamos on either side of the disabled machine. To make a change of this kind would probably occupy about 15 or 20 minutes.

The No. 13 Brush arc dynamos used in this case are standard machines, with shafts of greater diameter than usual to stand the increased strain, and a few minor changes because of increased diameter of shaft. By the use of the rubber buffer couplings, accurate alignment of the machines is not important, and at the same time the chance of any electrical connection between two machines at the coupling is reduced to a minimum.

This method of operating dynamos was not approved by engineers whom he consulted when originally suggested by Mr. Ellicott, but he felt from his own experience in the operation of arc dynamos he was entirely justified in carrying out the plan, with results that have been exceedingly gratifying and satisfactory.

The five machines have been operated under full load, and are run with the greatest possible success. They operate smoothly, noiselessly and without vibration. From the accompanying illustration it will be seen that, aside from the economy of operation by reason of belt losses and economy in floor space, the general appearance of the central station is markedly improved. Mr. Ellicott believes that it is only a question of time when all the large stations operating arc dynamos will adopt this plan.



A Novel Method of Operating Arc Dynamos.

LEGAL NOTES.

A performance of conditions beneficial to a municipality on which a street railway company is expressly required to accept from a city the use of streets is held, in People *ex rel.* Jackson *vs.* Suburban Railway Company (Ill.) 49 L. R. A. 659, to be the performance of a duty to the public which may be compelled by mandamus, and not the performance of a mere private contract.

An injured person who follows the suggestion of a physician sent to him by a person whom he had sued for injuring him, and tries to stand on an injured leg after he and his own physician have said that he can not bear his weight upon it, is held, in Pearl *vs.* West End Street Railway Company (Mass.), 49 L. R. A. 826, to assume the risk of so doing. With the case there is annotation reviewing the decisions on obeying or disobeying a physician as affecting the remedy of an injured person against the one who injured him.

Progress in Electrical Enterprise in Great Britain.

The capital involved in electrical undertakings in the United Kingdom has increased in one year from just £106,000,000 to £123,636,602, exclusive of the government telegraphs and telephones, the greatest increases having been in connection with supply, traction and manufacturing works. In five years the total capital has been doubled, while the money involved in electrical manufacturing concerns has increased from £6,500,000 to £21,708,180, and of this increase £5,000,000 is credited to this year—a large development for which some justification is to be found in the greatly increased use of electricity for lighting, power and traction. Five years ago less than £14,000,000 were thus involved; now the total is £55,000,000, and schemes projected will swell this total enormously in the next few years. Thus, in Parliament this year 98 provisional orders were granted for the construction of supply works, bringing the total orders still in force to 527; while many also of the 89 stations authorized in 1899 are not included in the capital sum named above. In operation, or under construction, there are 169 municipal and 108 company-owned stations, the sum involved in the former being £13,776,372, and in the latter £12,434,827. Under the former head there has been a very much greater advance than in the case of companies. Thus, five years ago, the capital of company supply stations was three times that of municipal loans; now the latter excels. In other words, the company capital has only doubled in five years; the municipal loans have increased sevenfold. In traction schemes there has been an increase in the five years from £6,000,000 to £28,890,000; but here private enterprise still holds the field, for of the total only £2,748,873 is held by 18 municipalities, while over £26,000,000 has been found by 75 companies. It would be easy to prove, also, that there has been great progress towards the reduction of costs of production. The average cost of generation has been decreased in five years from 2.45d. to 1.79d., with the corresponding reduction in other items, and the total cost is now 2.67d. against 4.07d. per Board of Trade unit. In five years the number of eight-candle-power lamps connected has increased from 2,000,000 to 7,660,000, and the units sold in even greater proportion from 30,000,000 to over 125,000,000. The price obtained for current has, in the case of companies, decreased from 6.08d. to 5.26d., and in municipal undertakings 5.32d. to 4.06d. per unit. The percentage of profit on capital expenditure has not increased, being, for municipalities, 4.90, and for companies, 5.45 per cent.—*Engineering.*

Cost of Electrical Plants in Europe.

The following interesting statistics of the cost of electrical plants in different cities on the continent of Europe have been compiled by Mr. Frank D. Hill, United States Consul at Amsterdam, Holland:

CITY.	Opening of electrical works.	Horse-power, inclusive of reserve.	Kilowatts connected n December 31, 1898.	Foundations, buildings and chimneys.	Lighting, cranes, heatings, coal transportation, tools, etc.	Boilers, feeding pumps, condensers, conduits, engines, apparatuses, etc.	Accumulators and transformers.
Vienna	Nov., 1890	11,500	11,545	.....	.....	.....	.....
Hamburg	Dec., 1891	3,600	3,902	$95,534	$9,408	$302,599	$86,958
	Nov., 1895	7,200	2,339	327,675	9,567	647,677	60,918
Frankfort	Oct., 1894	4,500	4,594	213,307	252,920	(*)	48,163
Dresden	Dec., 1895	3,840	4,493	140,949	7,507	186,991	29,905
Budapest	Oct., 1893	4,500	4,272	240,106	9,489	392,382	214,731
Leipzig	Sept., 1895	3,000	3,638	61,980	10,661	203,705	52,451
Nuremberg	May, 1896	4,000	3,405	171,947	9,744	161,966	71,371
Cologne	Oct., 1891	2,750	2,745	.....	.....	.....	.....
Stuttgart	May, 1891	2,200	2,704	78,653	6,033	212,349	56,251
Hanover	Mar., 1891	2,800	2,596	175,999	9,269	159,712	54,272
Christiania	Dec., 1892	1,900	1,906	80,211	13,776	149,557	31,583
Darmstadt	Mar., 1889	1,575	1,334	82,357	133,677	(*)	11,857
Chemnitz	July, 1894	1,800	1,457	47,856	(†)	126,881	217,109
Amsterdam:							
Electric	July, 1892	3,100	1,550	245,371	377,774	(*)	410,269
Municipal electrical works	.....	3,000	3,000	211,050	215,874	(*)	402,000

* Included in lighting. † Included in foundations.

CITY.	Cables and house connections.	Electricity meters.	Sundry expenses, principally supervision during course of buildings.	Total.	Cost per horse-power.	Cost per kilowatt connected.
Vienna	.....	.....	.....	$3,015,000	$262	$261
Hamburg	$1,425,134	$62,630	.....	3,068,401	286	.....
Frankfort	287,982	48,729	$51,005	934,268	207	203
Dresden	406,858	31,014	27,255	830,481	216	185
Budapest	397,893	71,618	.....	1,326,810	294	310
Leipzig	425,182	43,455	6,607	804,042	268	221
Nuremberg	223,761	56,127	44,139	739,037	185	217
Cologne	.....	.....	.....	649,324	236	237
Stuttgart	324,893	49,681	.....	727,861	331	269
Hanover	288,720	36,396	25,914	750,855	268	289
Christiania	114,325	26,633	20,998	487,082	230	229
Darmstadt	101,764	13,551	1,584	344,797	219	258
Chemnitz	(‡)	15,540	2,417	439,804	273	302
Amsterdam:						
Electric	(‡)	.....	.....	1,033,414	333	677
Municipal electrical works	(‡)	40,200	.....	869,124	290	290

‡ Included in accumulators.

New Management in Charge of the Erie Telephone System.

At a special meeting of the directors of the Erie Telegraph and Telephone Company, held at Boston, on January 16, the new management, representing the bankers' syndicate, took charge of the company's affairs. Charles J. Glidden resigned his office as president, and Charles A. Grant resigned the treasurership. Mr. Glidden has been connected with the Erie company nearly 18 years, being one of the organizers of the company in 1883. He has held the position of secretary, treasurer, vice-president and president. He has been connected with the telephone business over 24 years, starting the canvass for subscribers at Lowell in 1877 and serving a number of years as treasurer of several companies making up the New England Telegraph and Telephone Company, and later being secretary of that company, which position he resigned in 1884. Mr. Grant has been 17 years in the company's service. Mr. Glidden's successor was not elected, but Walker Abbott was chosen treasurer, and Mr. Grant was elected auditor. An executive committee, consisting of the following, will direct the affairs of the company for the present: Philip Dexter, chairman; William Endicott, Jr., Reginald Foster, Francis R. Hart, and W. J. Latta. The failure of the board to elect a successor to President Glidden is significant as part of a broad scheme, which, it is believed, will ultimately result in the absorption of this great property by the American Telephone and Telegraph Company. None of the officials, however, will openly admit that a deal of this sort is pending. Mr. Glidden will still continue for a time as a director, but he purposes shortly to retire from active business.

The town council of Halifax, N. S., recently had an expert examine the O'Dell Electric Light Company's plant, and the report received showed that the plant, exclusive of the real estate, is worth more than the amount asked the town by the company, the real estate being valued at about $1,000 over that.

A WONDERFUL WATER-POWER.

BY F. E. SANTOS.

Among the natural wonders of Arizona—the Grand Cañon of the Colorado, the Natural Bridge, of Pine Creek; Montezuma's Well, near Beaver Creek, and others—the springs of Fossil Creek are not to be accounted the least.

Here the water pours in torrents from the mountain side, hedged about with columbines, maidenhair and other ferns of great variety, and falls to the creek bed with the roar of the falls of Niagara in miniature, then rushes, leaping and foaming, down the rocky creek some 12 miles to the Verde Cañon and on to Salt River Valley, where it forms a large part of the constant supply for irrigation in that fertile valley.

If these springs and the beautiful woods and waterfall scenery below them were situated anywhere in the eastern states, they would be visited by thousands of wonder-seekers for their beauty and grandeur alone; but occurring, as they do, in the arid mountains of Arizona they become more wonderful, and useful, too, for power and irrigation purposes.

Fossil Creek has a fall generally estimated at 200 feet per mile, but to an observer looking down from the mountain side this would seem to be not enough, for its steep descent in falls and rapids keeps the water almost continuously white or foaming, and many falls from 10 to 30 feet occur within short distances; but this would, however, indicate a fall of 2,400 feet before it reaches the Verde Cañon.

Three enterprising gentlemen have recently secured title to these springs for electrical power purposes, and are constructing a waterway to convey the water to a site for a power-station, or possibly several stations, whereby they expect to secure 1,500 or more feet of fall. They will probably incorporate under the title of the Arizona Electrical Power Company, with headquarters at Jerome, which city is the nearest railroad connection at the present time.

A careful measurement of the water determines 4,200 miner's inches of constant flow, equal to 6,300 cubic feet per minute, which, with a fall of 1,500 feet, by reference to tables of power heads, and of 85 per cent useful effect, gives 15,200 horse-power.

This water-power is near the centre of the territory and is 40 miles southeasterly from Jerome, where Senator Clark's great copper mines are situated, and about Jerome, within a circle of 12 miles, are 22 other incorporated companies on as many

groups of mining claims, many of which have power plants installed for their working, the United Verde alone using about 3,000 horse-power of steam.

The city of Prescott is about 50 miles westerly from Fossil Creek, on the Santa Fe, Prescott & Phœnix Railroad, and as a railroad is now in operation, running to Seattle from a power-station 153 miles distant, it is easy to see this road could also be operated by Fossil Creek power, for Phœnix, its southern terminus, is not more than 70 miles away, and its northern terminus at Ash Fork is less than 100 miles distant.

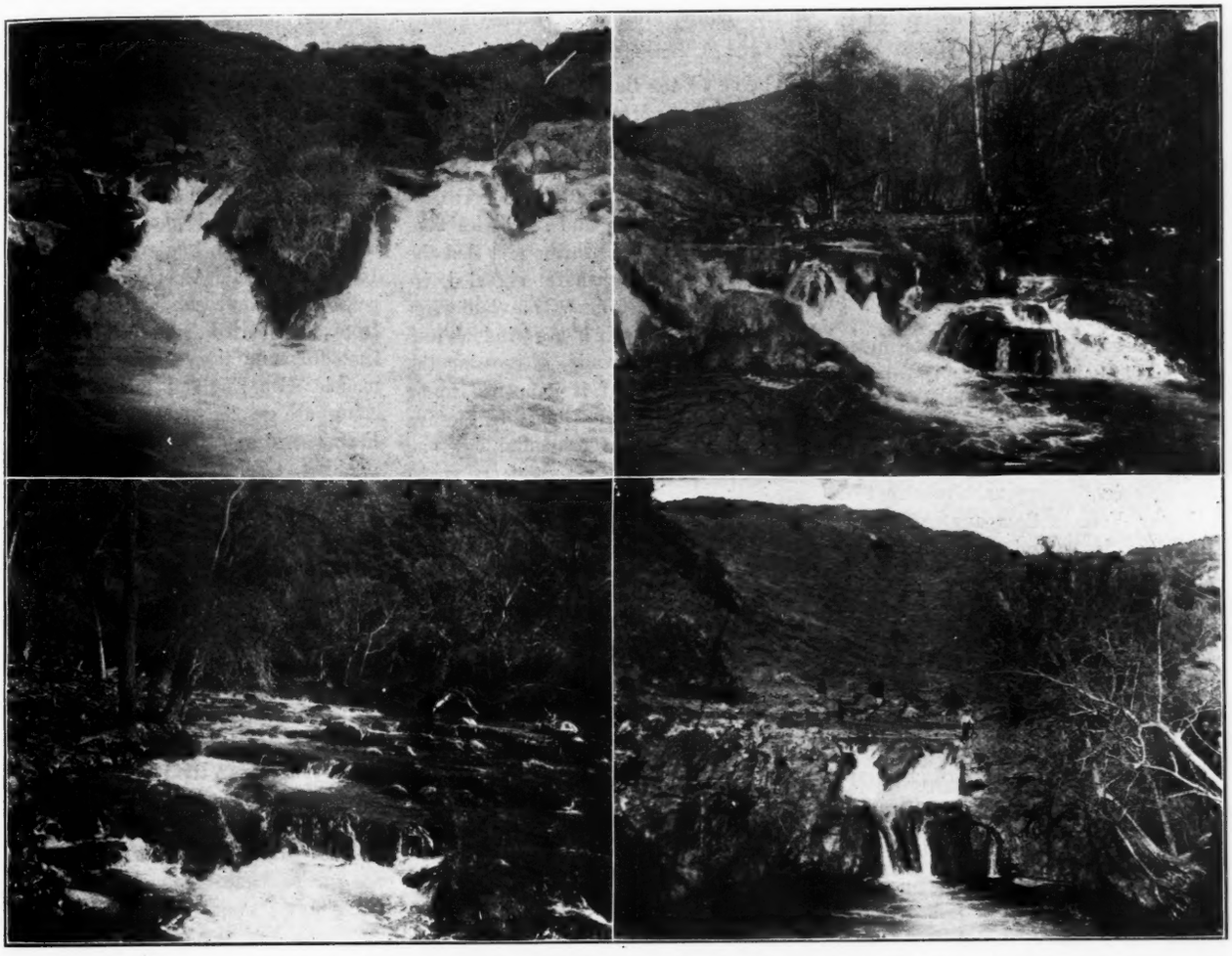
And nearer yet are the Prescott & Eastern, the United Verde & Pacific and the proposed railroad from Globe to Jerome and on to Williams, which are all easily within its effective power radius as also is the great mining country lying between Prescott and Phœnix, with its 100 or more mining camps and power plants, including smelting furnaces and reduction works, and the gold mines and mills of Congress, the city of Phœnix, whose population will soon equal that of Los Angeles at present, and those of Williams, Flagstaff, Winslow and of Globe, with its own great copper mines and smelters, and so from all appearances there would be a demand for electrical energy many times greater than Fossil Creek could furnish, which, in fact, will soon all be required at and in the vicinity of Jerome.

In taking this water away on a grade to a suitable fall and power-station, it is considered desirable to construct a flume, which will, in a warm and dry climate, save evaporation and also absorption, as would be the case in a ditch or canal, and here comes in a valuable feature to promote the enterprise in a forest of pine not more than six miles away, from which lumber can be furnished on the ground at $12 or less per 1,000 feet. A steel flume or pipe would be preferable, but more expensive, as a cylinder of five or six feet in diameter would be required —the diameter of pipe necessary to convey the water giving a good idea of the capacity of the springs.

The cost of installing a suitable plant and transmission lines properly to produce and distribute this power has not yet been ascertained, as only a preliminary survey has been made, but even if it should be $500,000, the sale of 15,000 horse-power at only $75 per year—which is but one-half the average expense of steam-power in Arizona—would cancel the entire cost more than twice over in one year.

When it is considered that there is no expensive dam building necessary to take out this water; that the flow is constant and unvarying every day in the year, unaffected alike bv storms, the melting of snow in the mountains, freshets or floods and their consequent debris, which must be contended with and provided for in most cases, and, on the other hand, undiminished by droughts, which greatly affect or entirely dry up other streams of some importance during a portion of the year, this must certainly be regarded as a wonderful water-power.

The pictures herewith presented are snapshots of the stream below the springs.



VIEWS OF WATERFALLS ON FOSSIL CREEK, ARIZONA BELOW THE GREAT SPRINGS

Automobiles

The Automobile Steering Company, of Trenton, N. J., has been recently incorporated for $50,000.

A company for establishing an automobile line in Baltimore, Md., has been recently chartered with a capitalization of $10,000 and will be known as the Columbia Automobile Company. E. P. Clark and others are the incorporators.

Reports from Boston, Mass., state that an automobile show will be held in that city in the Mechanics' Building, from March 4 to March 9 inclusive, the parties behind the show being the same people who promoted the Sportsman Show a year ago.

The many racing machines which have come to Newport, R. I., within the last year or so have given rise to a determined effort on the part of local capitalists for the building of an automobile race track, which will be constructed during the coming Summer.

Among recent incorporations is that of the Motor Vehicle Company, of Plainfield, N. J. Its capital stock is $250,000 and the incorporators are T. W. Burger, R. W. Burger, R. W. Weissenborn, of Jersey City; R. B. Constantyne, of West Orange; G. B. Hanford, of Orange; D. Bourne, of New York; G. H. Bruce, of Plainfield; G. H. Bruce, attorney, New York.

Senator Platt's bill permitting ferryboats and other vessels to transport automobiles propelled by and carrying gasolene was favorably reported to the Senate on January 17 from the Committee on Commerce. The law at present prohibits the carrying by passenger steamboats of any form of gasolene, which prevents the transportation of gasolene motor vehicles traveling under their own power.

If the present plans of the Denver, Colo., Wheel Club materialize automobile rides will be given from Denver to Cycle Park, in the Platte cañon. The company will be established to run vehicles regularly between the park and the city, and it is stated that the rides will not be confined strictly to the club members. Cycle Park is about fifty miles from Denver by rail, and the ride by automobile will be between 40 and 50 miles through one of the most picturesque portions of the country.

The township committee of a Jersey village recently stopped an automobile race over the county roads in that town, greatly to the discomfiture of the members of the automobile club, the cause for the prohibition being that a week previous one of the racing automobiles had frightened a horse belonging to one of the committeemen. When the gentleman remonstrated with the *chauffeur* a hot exchange of words followed and the committeeman finally resorted to his authority and prevented the race. The farmers in the vicinity are said to be in sympathy with the committeeman.

The new Back Bay automobile omnibus line, in Boston, Mass., has met with such success so far that it is referred to by local papers as having made a "hit." Traffic on the line was fully up to the expectations of the company and the ladies were particularly pleased with the fact that the 'buses would stop whenever signaled, irrespective of street corners. Many ladies signaled them from their house windows and thus avoided the necessity of crossing the street in the mud if it happened to be rainy, and often saving time. In the five hours of the first experimental day one vehicle carried over 70 passengers at 10 cents apiece, and the three in use carried altogether 175.

A resident of Bangor, Me., has invented a self-propelled sled which he has called an "automosled." When completed the machine will be 10 feet long, 3 feet high and 4 feet wide. Its propelling mechanism will consist of two steel cylinders 10 feet long and 26 inches in diameter, wound around their periphery with spiral steel cams two inches high and three inches wide. The surface of the cams is deeply concaved, being designed to take hold of the most slippery surface of ice or snow. The bevel gearing between the cylinders and the engine is of such a nature that the speed can be easily regulated to suit the driver. The cylinders run for and aft with the sled and the power is so arranged that the gasolene engine which runs the power apparatus can not become centred. The whole sled, including its tubing, framework, engine, cylinders and steering runners, weighs but 1,200 pounds.

Society people seem to be always looking for something new and bizarre with which to startle their friends. Ladies like to make excitement by trotting around the streets with strange pets or doing curious and inexplicable things, which, if they were done by a man, would be considered sure signs of mental aberration. The latest exploit of this sort is that of a Boston woman who gave an automobile dinner not long ago. The affair was stated to be strictly original in every respect, inasmuch as the guests were driven first to the Hotel Touraine where oysters were served, being brought out and given to the guests while sitting in their carriages. After that the Adams House was visited, where soup was brought out to them, and so on around to all the fashionable inns of the "Hub" until a 10-course dinner had been partaken of, the meal ending at a famous Chinese restaurant, where "chop suey" was the "finish."

An automobile expert, who has recently returned from a tour through Europe, made with the idea of determining the situation in foreign countries, states that the American built machines are taking the first rank in England, just as 10 or 15 years ago all American buggies compelled German coach builders to import from the United States until they had time to manufacture carriages after our models. In England most of the machines are gasolene motors imported from France, and are said to be noisy and evil smelling, with more mechanism than a Swiss watch, while electric vehicles are unknown, excepting only those of American make. There are a few of these and they are said to have taken the automobile fraternity by storm. "In Paris there are a great number of gasolene cabs and hotel omnibuses, which make a noise like a cotton mill and leave a trail like a polecat, but they are not of the sort that would meet with any degree of public favor here. Some of them are built to look more like carriages and less like a Chinese puzzle turned wrong side out, but the internal mechanism is so complex that when they are turned loose on a rough road something drops every time. The American machines, both electric, steam and gasolene, are so constructed that they will stand almost anything, and it was easy to pick one out almost every time along Piccadilly or in the Bois on account of its handsomer lines and more nearly noiseless running."

Electrical Exports to Japan.

All things considered, Japan is as enterprising a country where electricity is concerned as Italy, and the steamer Albenga has recently taken $23,000 worth of electrical machinery to Kobe. Trade with Japan has improved considerably during the past month and American manufacturers anticipate heavy contracts, principally in railway equipment and electrical and mechanical engineering lines.

The Northwestern Convention.

Semi-Annual Gathering of Members of the Northwestern Electrical Association at Milwaukee, Wis.

The ninth annual convention of the Northwestern Electrical Association was held at Milwaukee, Wis., January 16, 17 and 18. The headquarters of the convention were at the Hotel Pfister and the various meetings were held in spacious rooms fitted for such gatherings. As in former years, this convention brought together the leading central-station men of the Northwest. The manufacturers of lighting and central-station apparatus and the various supply houses were well represented, and the gathering was another illustration of the popularity of these annual meetings. Since its formation this organization has been steadily increasing its membership until now it comprises all stations of any importance, both large and small, within the limits of the Great Northwest. They are always enjoyable affairs, these meetings, where business conditions for the preceding year are carefully reviewed, papers read and listened to with interest, and where excellent good-fellowship prevails at all times. A theatre party and the annual banquet were part of the entertainment supplied by the committee in charge of the comfort of the delegates.

WEDNESDAY, JANUARY 16.

The morning session convened promptly at noon at the Hotel Pfister, in the club room, and the minutes of previous meetings were adopted as printed. An adjournment was then taken until 2.30 P. M., at which time the president, Mr. Pliny Norcross, read his address.

Mr. Norcross's address was a business-like paper referring to the particular problems encountered by central-station men in competition with municipal ownership, and regarding such matters as taxation and the general treatment accorded electric lighting companies by municipalities and other governing corporations.

Following the presidential address came the report of the secretary-treasurer. This was duly adopted and Mr. E. L. Debell, chairman of the legislative committee, then presented his report. This dealt with license fees and percentage taxes in the state of Wisconsin, and other matters concerning the taxation of electric lighting enterprises. A number of applications for membership were received after the reading of this report, after which a number of letters of regret from gentlemen unable to attend the convention were read. Several committees were appointed, and the paper by Mr. H. L. Doherty, of New York, on "The Rate Question," was then read by Mr. Debell. This paper will be found elsewhere in this issue of the ELECTRICAL REVIEW. It was followed by Mr. L. W. Burch's paper on "Practical Line Construction," which is also reprinted elsewhere in this issue. A discussion of Mr. Burch's paper was opened by Mr. George Cutter and participated in by Mr. John Schuette, Mr. Debell, Mr. Grover, Mr. Bowen, Mr. Alberts and the secretary. Adjournment was then taken until the next day.

THURSDAY, JANUARY 17.

The morning session was called to order in the club room at noon with the president in the chair, and a number of applications for active membership were acted upon favorably.

A letter was read from an electric light company inquiring about meeting the competition of gasolene street lighting. This precipitated a considerable discussion. Mr. Gille spoke of the experience in Chicago, as did also Mr. J. M. Hill, Mr. Thayer and Mr. Cutter. Mr. Strong, of Baraboo, Wis., told of an experience that his town had had with Welsbach mantle gasolene lamps for street lighting. The town pays $62.50 a month for the lamps, not including gasolene and breakage. The lamps soon destroyed themselves, the parts being so small that they do not stand the heat and are very liable to work imperfectly. He did not think the candle-power was very high, and the lamps deteriorate very rapidly in service. Mr. Grover said his company had had active opposition from the same class of lamp. Mr. Debell related the experience he had had in Sheboygan, Wis. He did not think it was a serious competitor of the electric light, although the lamps were being actively pushed in numerous western towns. He thought that it was a competitor of the kerosene lamp rather than of the electric light for street illumination. The lamps, he thought, were very dangerous and gave off a disagreeable odor. In addition, it was difficult to light the lamp, requiring a blow torch or something of that kind to start it going.

Mr. Livermore called attention to the failure of the insurance laws to take into account storage of gasolene in such lamps when used indoors. Mr. I. P. Lord, of Waupaca, told about the lamps being introduced in that place. The third night of running one exploded in a man's store and electric lighting business has been good ever since. Mr. R. S. Kountz told of a customer of his who displaced 22 incandescent lamps and one arc with six gasolene lamps, but soon shifted back to electric lighting. Mr. Thayer described the different qualities of gasolene on the market and said that the western product contained a considerable residuum of tar and heavy oils which were not fully vaporized in the flame and hence form a black, thick gum, soon putting the lamp out of operation. If the use of gasolene extends to any great extent the price of the eastern oils, which are the only kind fit to use, will go up considerably. Mr. Grover said that the trouble he had found was that gasolene lamps in buildings blew up and set fire to the premises, thereby causing his electric light company to lose lamps, fixtures, meters, etc. He believed that the insurance companies should take more interest in the gasolene lighting schemes, which he regarded as very dangerous. Mr. Livermore made a motion that three members be appointed as a committee to examine and report upon the advisability of presenting the facts to the attention of the insurance commissioners in various states.

The discussion at this point became general. Mr. Gille offered an amendment to the pending motion that the committee report to the association at the next meeting all the information it could obtain on the subject of gasolene street lighting. Mr. Copeland, speaking on the motion, said that he was afraid that putting the gasolene lamp out of business would encourage stronger competitors.

The report of the committee for Summer meeting was then presented, this being that the meeting be held during the last week in June, at Sheboygan, Wis. The report, after considerable discussion of a good-natured character, was adopted by unanimous vote.

Professor W. E. Goldsborough, of Purdue University, then read his paper entitled "Synchronous Converters." This paper will appear in an early issue of the ELECTRICAL REVIEW. Adjournment

was then taken until the afternoon, the session meeting at 2.30 P. M. A number of communications and a number of applications for membership were also made.

The committee on nominations then presented its report, recommending the election of the following officers: President, E. L. Debell; vice-president, S. B. Livermore; second vice-president; W. W. Bean; secretary and treasurer, Thomas R. Mercein; directors: L. E. Kerns, Wisconsin; J. H. Harding, Indiana; Charles Cuno, Wisconsin. The officers were duly elected as nominated. It was decided to send Mr. Mercein, the secretary, as a delegate to represent the association at the meeting of the National Electric Light Association, in New York city, in May. The new president was then escorted to the chair, where he made a few appropriate remarks. A vote of thanks was tendered the retiring president for his faithful and efficient services.

The discussion of Professor Goldsborough's paper was then taken up and opened by Mr. Gille, Mr. Ahlmert, Professor D. C. Jackson and others.

Mr. B. D. Wagoner then read a paper on the subject of "The Series Incandescent Lighting Systems of the Future." Considerable discussion followed the reading of the paper, showing a deep interest on the part of the members in the subject matter.

Professor D. C. Jackson, chairman of the committee on correspondence schools, then presented a report on the subject of the "Trade Education of Central-Station Employés." This report was of considerable length and went into the matter thoroughly. The report in general was a commendation of the correspondence system of instruction, and concluded with the recommendation that action be taken requesting the various correspondence schools to organize and administer a course of instruction for central-station employés conforming to the recommendations of the committee and that the committee be continued for further investigation of the results attained. Professor Jackson related, at considerable length, the experience of the committee in obtaining the information reported upon. The recommendations of the committee were adopted by unanimous vote. Upon motion of Professor Jackson the correspondence schools referred to in the report were requested to reorganize their courses in conformity with the committee's recommendations. Mr. Bowen spoke at some length in commendation of the committee's work. Mr. Livermore said that the tendency of correspondence instruction was to elevate the man, whereas if one wanted a perfect fireman he did not want to lose him but to have him stay in his position. Mr. Gille thought that the number of students that finished the courses is so low as to indicate that something is wrong with the system. He thought that men were required to study a lot of things that they did not feel interested in and were liable to skip through the course, picking out only what interested them. Mr. Ahlmert said that he had good results from instructing his own men by means of the leaves published by a correspondence school. Mr. Cutter commended the work of the committee. Mr. W. L. Elliott said that he thought the education ought to begin with the head of the house; the proprietor should always be willing to advance the interests of his men. The discussion at this point became general.

Adjournment was taken until 10 o'clock the next morning.

No business being before the session when it met on Friday it was adjourned *sine die*.

CONVENTION NOTES.

E. Bookwalder represented A. L. Ide & Sons, of Springfield, Ill.

The Viscosity Oil Company was represented by S. A. Johnson, Frank Travers and J. C. Blackford.

The Sawyer-Man Electric Company was represented by Mr. Clarence A. Ross and Mr. R. S. Mueller.

The Guarantee Electric Company, of Chicago, was represented by the president, Mr. Chas. E. Gregory.

L. W. Burch, of Electrical Supply Company, Madison, Wis., was present in the interests of his company.

Pass & Seymour and the Crouse-Hinds Electric Company were represented by John W. Brooks, of Chicago.

The Buckeye Electric Company and the Jandus Electric Company were represented by J. H. Cooke, of Chicago.

The John A. Roebling's Sons Company was represented at the convention by Mr. Millard B. Kitt, of the St. Paul office.

The American Steel and Wire Company had Mr. E. J. Pietzcker, of Chicago, as its representative at the convention.

The Manhattan General Construction Company, of Newark, N. J., had Mr. Frederick L. Merrill at the convention.

Professor D. C. Jackson and Professor Bernard V. Swenson, of the University of Wisconsin, were present at the convention.

Mr. S. A. Duvall, of the Kellogg Switchboard and Supply Company, of Chicago, was present at the convention.

The Macomber-Whyte-Leschen Company, of Chicago, was represented by Geo. S. Whyte, who is always present at conventions.

The Columbia Incandescent Lamp Company, of St. Louis, Mo., was represented by the northwestern manager, James B. Coale. Columbia lamps were shown in the parlors occupied by Mr. Coale, where photometers and other testing instruments were operated.

The genial Chicago representative of the New York Insulated Wire Company was James Wolff, who was very much in evidence at all times.

The American Electrical Works, of Providence, R. I., had its interests well looked after by F. E. Donohoe, the western agent for the company.

The General Incandescent Arc Light Company's exhibit was well presented by Mr. Francis Raymond, of Chicago, and Mr. Thomas James, of Milwaukee.

B. F. Stewart, representing the Warren Electric Manufacturing Company, Triumph Electric Manufacturing Company and J. Holt Gates & Company, was at the convention.

The Chicago Mica Company, of Valparaiso, Ind., was represented by Charles W. Cobb, general manager and vice-president of the company, who secured some valuable contracts.

The Wagner Electric Manufacturing Company, of St. Louis, Mo., was represented by Mr. George B. Foster. Mr. Abadie, who usually attends these meetings, was unable to be present.

The Belden arc lamp, made by the Belden-Larwell Manufacturing Company, Fort Wayne, Ind., was shown in the parlors of M. B. Austin & Company, Chicago agents. Mr. Belden was present.

The Dearborn Drug and Chemical Works, Rookery Building, Chicago, had Mr. James W. Harkins at the convention. It distributed souvenirs and handsome calendars to all visitors at its rooms.

The Hart Manufacturing Company, of Hartford, Ct., showed a full line of switches made by the company. Its exhibit consisted of the various lines of electrical accessories made in its shops.

The Christensen Engineering Company, of Milwaukee, extended to the visitors a handsomely engraved invitation to visit the new plant of the company in Milwaukee. Its interests were looked after by Mr. George B. Cadwell.

M. B. Austin & Company, general western agents for Dayton Fan and Motor Company, Belden arc lamps, Safety wires and cables, K. K. weatherproof wire and Loricated conduit, were represented by M. B. Austin, Arnold Friend, A. Meinema.

Mr. John T. McRoy, the well-known manufacturer of the McRoy conduits, has recently effected a new organization to be known as the McRoy Clay Works, with headquarters as heretofore at New York and Chicago. E. F. Kirkpatrick is western manager.

The Electric Appliance Company, of Chicago, was well represented at the convention by the following gentlemen: W. W. Low, president; W. P. Upham, S. A. Rall and B. B. Downs. They distributed a unique souvenir in the shape of an advertisement contained within the shell of

a peanut. This displayed the qualities of the A. B. lamps, Guttman meters and other various specialties.

The Gregory Electric Company, of Chicago, was too busy to prepare an exhibit, but reports doing more business in 1900 than in any year previous. It reports unusual sales in large apparatus as well as small machines. The company was represented by A. L. Kuhmstead and R. H. Watson.

The Richmondt Electric Wire and Conduit Company, of Milwaukee, had an exhibit in connection with the Electric Appliance Company, its Chicago agent. It showed specimens of steel-armored conduits and other products made by the company. It was represented by Mr. C. D. Richmondt.

The Illinois Electric Company, of Chicago, was represented by Lem. C. Cushing and C. W. Bacon. An exhibit of Peerless transformers and fan motors made by the Warren Electric and Specialty Company, of Warren, Ohio, was shown. The Illinois Electric Company is western agent for the Warren company.

The Bryan-Marsh Company, of New York, maker of Imperial lamps, was represented by Converse I. Marsh, president; Guy V. Williams, Minneapolis office; Geo. B. Keesh, Chicago office, and L. P. Sawyer, Chicago office. Photometers for central stations and samples of lamps were shown, also a new electric comparimeter.

Mr. E. F. Kirkpatrick, who has been identified with electrical interests for the past 15 years, has recently been appointed western manager of the McRoy Clay Works. "Kirk" has a wide acquaintance among the central station and street railway companies and will undoubtedly be as successful in his new field as he has been in the past.

Prominent among the exhibitors at the convention was the Western Electric Company, of Chicago. Its headquarters in the hotel contained an elaborate and interesting display of arc lamps, incandescent lamps, ceiling and desk fans and motors. The company was represented by Mrs. A. L. Tucker, Irving Jackson, E. P. Warner and Fred Basedow.

The Westinghouse Electric and Manufacturing Company had an exhibit consisting of a testing board containing measuring and indicating instruments, fan motors, lightning arresters, transformers, etc. Those present for the company were W. R. Pinckard, C. G. Burton, T. P. Gaylord and W. S. Rugg. Arthur Hartwell, of the Chicago office, was unable to attend.

The General Electric Company's exhibit consisted of a line of switchboard instruments, wattmeters, arc lamps and the series incandescent system for street lighting, with reactive coil automatic regulator. The representatives present at the convention were Messrs. Wagoner and Vaughn, from the Schenectady works; Thos. Ferris, Wisconsin agent, and Messrs. Boyer, Dibble and Scribner, of the Chicago office.

The Fort Wayne Electric Works, Fort Wayne, Ind., had an exhibit of transformers, integrating wattmeters, its new "Type K" indicating instruments, fuse boxes, automatic rheostats with cutout switches, etc. Its exhibit was attractively displayed and Mr. W. C. Knight, Frank McMasters, Colonel Charles A. Munson, manager Chicago office; E. J. King, meter department, and E. A. Wagner, engineering department, were present for the company.

The Cutler-Hammer Company, of Milwaukee, had several of its rheostats in operation at the various exhibits of motor and dynamo manufacturers. This company states that it is having a large demand for its new type of enclosed field rheostat. It is also selling a large number of self-starters for pump and elevator work and recently shipped one of 150 horsepower to the Charleston Navy Yard. A most complete catalogue of controlling devices—"Catalogue No. 300"—will be mailed free upon request. Messrs. Hickox, Bacon and Cutler were present at the convention.

The Shelby Electric Company, of Shelby, Ohio, manufacturer of incandescent lamps, had an exhibit in its parlors consisting of photometric tests and various types of lamps. The tests were for demonstrating the claim that Shelby lamps gave 50 to 100 per cent more light on a basis of useful illumination than other types of lamps in the markets. The exhibit was in charge of Mr. O. D. Pierce, who reports that the company is interesting buyers from all over the country with the arguments of "Useful Light." He was assisted by C. A. Meade and W. S. Reynolds.

The Browning Manufacturing Company, of Milwaukee, exhibited a complete line of its motors, from one-twelfth to three and one-half horse-power, in all speeds. This concern has established an enviable reputation as a maker of strictly high-grade motors and generators. Its apparatus is in great demand with that class of trade who aim to use nothing but the best. The Browning company is on the point of moving into a spacious new factory which it has designed and built with special reference to the demands of its product. The company was represented at the convention by Wm. Stark Smith, secretary and treasurer, and Mr. Theo. Hirtz.

The Milwaukee Electric Company, of Milwaukee, showed in its parlors a number of machines in practical operation, one two and one-quarter horse-power, slow-speed, and one seven and one-half horse-power, slow-speed motor; also a type of special slow-speed motor for direct-connection to printing-presses, fans, etc. The machines show an especially fine finish and altogether the display was one of the best at the convention. It might be of interest to note that the Milwaukee Electric Company has plans drawn for a new shop which will increase its capacity about threefold. It expects to begin work on the building within the next two or three weeks. Mr. Walter Cary, Mr. Wm. P. Harper, Mr. Irving Cary, W. H. Perry were present at the convention.

Telephone and Telegraph

A franchise has been asked for by Judge Silas B. Spier, of Mt. Clemens, Mich., for a new telephone system in that town.

The Southern New England Telephone Company announces a reduction of 25 per cent in the private and thirty-three and one-third per cent in the business rates of all Connecticut towns where there are less than 160 subscribers.

Assemblyman Sanders, of the Borough of Manhattan, New York city, will soon introduce a bill into the Assembly at Albany, asking for a regulation of telephone tolls in New York city, his object being to reduce the figures.

The Southern New England Telephone Company has declared a regular quarterly dividend of one and one-half per cent, payable January 15 to stock of record December 31. The annual stockholders' meeting will be held on January 29 at New Haven, Ct.

An agent of the United States Telephone Company, with headquarters in Cleveland, Ohio, has been visiting property owners living on the road between Thompson's Corners, north of Cuyahoga Falls, and Medina, for the purpose of securing right of way for a proposed line between these points.

The Cumberland Telephone and Telegraph Company has recently purchased the entire plant and lines of the Alexandria, La., Telephone Company, Limited, for $5,000 cash, and took possession on January 1. An official of the company stated that it would in the near future construct lines between Chattanooga, Tenn., and Rome, Ga. In addition to this, lines will be strung from Knoxville, Tenn., directly to Jellico and thence to Lexington and Louisville, all in Kentucky.

A telephone conversation was recently held under the Gulf of Mexico between Key West, Fla., and Havana, Cuba, the tests being made by an agent of the Southern Bell Telephone Company, of Atlanta, Ga., through the courtesy of Manager Atkins, of the Key West station of the Interocean Telegraph Company. These tests were not absolutely satisfactory, demonstrating the impracticability of successful conversations by cable under water, presumably on account of imperfect condensation. Reports of the conversation state that the voices sounded muffled and were merely indistinguishable and blurred sounds, as though they came from some big underground cave.

THE RATE QUESTION.*

BY HENRY L. DOHERTY.

At the last meeting of the National Electric Light Association, I read a paper entitled "Equitable, Uniform and Competitive Rates." I proposed a rather radical departure from our present methods which seemed to me a logical solution of many of the difficulties which now confront us. Before adopting a rate system differing radically from all methods with which I was acquainted, I wished to obtain an expression of opinion from representative central-station men which I thought would prove my plan either meritorious or otherwise. The discussion this paper provoked was not general, and no valuable points were developed. The sentiment at the meeting was unfavorable to the plan I outlined. The paper received but little comment from the electrical press, and was read in full only by those who chanced to obtain an advance copy, published for the meeting. Since the Chicago convention to the present date I have been kept busy answering correspondence regarding this rate system, and few of my correspondents seem to have gained from my paper a clear understanding of my views. The plan I then outlined seems to have grown greatly in favor, and many of its early and most pronounced opponents now express themselves as believing that it offers the best solution yet proposed towards the establishment of equitable and uniform rates.

After reading my former paper, I found it a hardship to answer all of the correspondence received, owing to the fact that many inquiries were made without having carefully read and considered my paper. To have answered some of them fully would have necessitated a repetition of much that had already appeared in printed form. I can not attempt another exhaustive treatise on this subject, but if any one is sufficiently interested in this matter to carefully read this paper, and also my former paper, which will be found in the published proceedings of the last convention of the National Electric Light Association, I will not only willingly answer any inquiries they care to make, but will welcome any discussion of the subject by correspondence.

There are really but two distinct methods of charging for electric service, viz.: First, flat rates; second, meter rates.

An analysis of flat rates would mean, a definite charge for a fixed capacity, regardless of quantity of current used, within a limit of no use, to constant use. This would work out to a minimum kilowatt rate, for current, of the fixed rate, divided by the maximum consumption, to a maximum kilowatt rate, to infinity, if no current were used.

An analysis of meter rates would mean, a fixed charge per unit of current sold, regardless of capacity demanded. In this case the station's cost to produce would vary from the very low cost per kilowatt-hour, if total capacity were used continuously, to infinity, if no current were used. In the abstract, flat rates are preferable, as they give the station the advantage of the infinity end of the variation, but both systems seem to me almost absurd.

Theoretically, flat rates can be placed sufficiently high to absolutely protect the station from loss, but such rates would drive away much profitable business.

Meter rates can not be placed so high but that loss may result. Even if a consumer agrees to pay $1.00 per kilowatt, his consumption may be so small that his total payment will not equal the cost of reading his meter, keeping books for his account, core loss of transformer capacity, and shunt loss of meter.

It is probably unnecessary to comment on the inequity of flat rates, but rates based solely on consumption, without considering the maximum demand that the station must be prepared to supply, are often even more inequitable.

An analysis of the accounts of one central station with which I am familiar, will illustrate the relative worth of different consumers supplied on meter basis. A minimum bill of $1.00 per month is now charged, if no current is used. This means a minimum of $1.00 per lamp per month, if the consumer has but one lamp, and $.001 per lamp per month, if the consumer has 1,000 lamps. At this particular station, the average yearly bill is $1.96 per lamp, the minimum yearly bill is 24 cents per lamp, the maximum yearly bill is $38.46 per lamp.

Assuming that the station represents an investment of $20.00 per lamp wired up, this means that for these different classes of consumers, were all the consumers of one particular class, the lengths of time for our gross revenues to equal our investment; for the average consumer, 10 years and 2 months; for the minimum consumer, 83 years and 4 months; for the maximum consumer, no years and 6 months.

If the entire amount paid by the minimum consumer were clear profit, you would be earning but one and four-tenths per cent on your investment. The consumer using the least current, may add just as much to your absolute maximum demand, as any other consumer you have. I once cited the case of a church, which is generously equipped with lights, but which for several years past has used light but one night each year, and that night is Christmas Eve, or the preceding night.

Charging a fixed rate per kilowatt hour on meter basis bears no relation to cost of service. Cases may sometimes be best illustrated by exaggerations. Suppose you should receive an application for a 2,000-light connection to be used as a relay in case of a breakdown of an isolated plant. At what rate per kilowatt could you afford to supply the applicant with current? This is the same problem which confronts us on a modified scale with each consumer.

Our costs are fixed by: 1. The number of consumers we have; 2. Distance from the station; 3. Capacity they demand; 4. Amount of their consumption.

Distance from the station is influenced by where we locate our station, and I see no reason why we should vary the cost to different consumers because of varying distance from the station, except in extreme cases. For lack of time I will drop this item of cost from further consideration and go on to the others.

There are certain costs, such as bill-making and meter-reading, which are entirely fixed by the number of consumers or meters, and many of our other costs are virtually fixed by the number of consumers or meters we must care for, such as meter-testing and maintenance, office rent, complaints and gratuitous work, superintendence and inspection. To cover such expenses as these, I propose to have a fixed charge for each consumer, regardless of his consumption or the size of his installation, provided no more than one meter is installed.

There are certain other costs which are fixed by the capacity demanded, such as interest on investment, transformer losses, maintenance, depreciation, etc. To cover such expenses as these, I propose to have a fixed charge for each lamp the consumer's connection will permit him to demand, without regard to the number of lamps installed, or amount of current used.

There are other charges which are fixed by the quantity of current generated, such as boiler fuel, lamp renewals, etc. To cover such expenses as these, I propose to charge a fixed and uniform rate per kilowatt-hour consumed.

A moment's consideration will, I think, convince all of you that outside of boiler fuel and lamp renewals, your operating costs would not be greatly increased if you operated 24 hours per day at your maximum load, nor would they be greatly diminished if you operated but five minutes per day at your maximum load, assuming, of course, that you stood ready to serve current at any time throughout the 24 hours should it be called for.

A charge for "readiness to serve" fixed on this basis, and a low kilowatt-hour rate, will bring about many advantages to the central stations, and protect them from loss, unprofitable patronage, and, I believe, will also protect them from undesirable legislation.

I recognize the fact that any change in methods of charging will cause trouble, if enforced suddenly on those consumers whose bills it will increase, but this system can be used in place of horizontal reductions in the rate now charged, and can reasonably be exacted from new consumers, and eventually made universal. Evolution, not revolution, must be the policy of all quasi public corporations. In view of the fact that it will be inadvisable to enforce this system on old consumers who will be injured by its adoption, I propose to adopt it first as a substitute for all special rate consumers, and also for new consumers. Instead of dividing my expenses as they exist to-day and apportioning them among the consumers on this basis, I expect to adopt such charges as will benefit long-hour, and, therefore, profitable, consumers to such an extent as can be readily compensated for by the additional business which can be secured

* A paper read before the Northwestern Electrical Association, Milwaukee, Wis., January 16-18, 1901.

with a lower rate per kilowatt-hour. I will continue the rate cutting by small steps, so long as I can protect the company's net earnings from marked shrinkage.

In one station where we have been experimenting we are convinced that it is more profitable to supply consumers on this rate system, making a fixed charge of $6 per consumer per year, plus $1.80 per lamp demanded per year, to which is added four cents per kilowatt-hour for current used, than to sell at a straight rate of 10 cents per kilowatt-hour. It is needless to call attention to the fact that consumers will be much more liberal in the use of current when supplied at four cents than 10 cents per kilowatt-hour. My plan is to make all contracts for a year or more, allowing the consumer to contract for any capacity he may choose; the capacity to be increased whenever he desires, but not to be decreased except at the expiration of the period contracted for; the capacity to be limited by a suitable maximum demand cut out to prevent him from demanding more capacity than he contracts and pays for, and one-twelfth of the fixed charge to be included in each monthly bill.

This system, I believe, can be rendered absolutely uniform, both for light and power, and will prove more equitable than any other system.

A reduction of the kilowatt rate should be made for current supplied for power purposes, to compensate for higher costs of lighting service, owing to the exact degree of regulation necessary, and the cost of lamp renewals, which is a more important item than is generally believed.

I have no patents or copyrights on this system, or the appliances its use demands. Anybody can use it as described, or as they care to modify it.

The system is already in use in one central station with which I am connected, and we are about to put it in use in two others. It has also been partially adopted by other central stations with which I have no connection, and for which I have no authority to speak.

PRACTICAL LINE CONSTRUCTION.*

BY LOREN W. BURCH.

This is a subject that should have been given a more fluent writer. How to construct a pole line correctly has undoubtedly agitated many minds before now. In the early stages of construction a great amount of groping and feeling in the dark was indulged in and when we see some of the work that is done to-day it looks as though daylight had not yet come for some of us. Pole-line construction has permitted a vast amount of fanciful ideas, emanating from the minds of those therein engaged, because no specifications have as yet been produced to form a standard which could be followed with success.

* A paper read before the Northwestern Electrical Association, Milwaukee, Wis., January 16-18, 1901.

The importance of good line construction is made apparent by the increased expenditures caused by a poorly constructed line. It may be that a line-repair account is not kept; under such circumstances it is possible that the line itself is not kept in proper repair. Keeping the line in good condition and keeping a strict account of same should go hand in hand. A line poorly constructed means a waste in dividends; money spent for repairs on work originally badly done, that should have entered into the first cost, is worse than money thrown away. To construct a first-class pole line at the start is to save money and give character and stability to the line and increased value to your property. It will also inspire confidence in your customers and bring forth words of praise that mean business for the plant.

There are three great evils which are always at work doing their best to defy success in almost all kinds of construction. In pole-line work we find: First, ignorance; second, false economy; third, dishonest contractors. No matter how good a standard you might have, any of these elements is enough to work sad ruin to an investment of this nature. As regards pole-line construction, where will we begin? I would suggest with the pole. We experience little or no trouble in getting good, dry live cedar poles that are graded to a standard set up by the pole dealers.

The pole should be well peeled, dressed up, housed and gained. One, two or even more extra gains should be cut while the pole is down, as it is much easier and more cheaply done on the ground. We will not go into details of setting poles in this paper, but suffice it to say that a pole well set and tamped is half guyed. No matter how good your poles may be or how straight the line in which they are set, if they are not properly guyed you will have a poor piece of work on your hands when through. It is safe to say that a properly guyed pole line will enhance its value fully 50 per cent.

I do not advocate the use of the so-called hand-made guys, as to make a stranded guy is a difficult task for men to perform and get each strand of equal tension. Machine-twisted guys are cheaper, stronger and more easily handled. Guy clamps should be used in all cases, as it permits of coming up with the end and taking the slack out of a guy, if necessary, without cutting it. Guy rods are better than ungainly looking posts and should be used wherever possible. All guy wires should be fitted with circuit-breakers, placed at a distance of six to eight feet from the pole end, to prevent accidents and grounding from live guy wires. Guying to trees, buildings, etc., should be avoided entirely, as other people's property is not yours and you can not make it so by making fast to it in this manner.

In the construction of the ordinary plant the subject of guying is an after consideration and if a guy is put up one end is made fast to the pole and the other to some man's house, barn or tree. This is bad practice, even if the permission of the owner is granted, as the ownership of these buildings may be changed at any time. Special attention should be paid to all corner, junction and end poles, for there will be no end of trouble when you commence to pull up your wire.

In digging holes, it is immaterial whether you commence at the top and work down or at the bottom and work up. To dig the hole in the shortest possible time is the object in view and the nature of soil will always dictate the mode of procedure and tools to be used. The important part of the hole is the filling of it. Dry, loose dirt and rock well—exceedingly well—tamped will always hold a pole in place.

Cross-arms are made in standard sizes and spacings of not less than 18-inch centres and 17 inches between pins should be used on all lines carrying 1,000 or 2,000 volts. Cross-arms should be doubled on all corner, junction or end poles. On six and eight-pin arms nine-sixteenths by nine-inch lag screws should be used and not less than one-quarter by one and one-quarter by twenty-six-inch cross-arm braces. Some superintendents insist upon having galvanized iron throughout; this is undoubtedly all right, but it is not absolutely necessary in all cases. It depends upon the color the poles are painted. Cross-arm braces should be used on all cross-arms over three feet long and I would recommend their use on two-pin arms if a heavy wire is carried upon them.

Good live oak pins are all right to use on straight runs or light wires, but on corner or junction poles locust pins should be used. On wires from eight to four naught it would be better construction to use iron pins to support the heavy strains put upon them.

The height of poles is a matter that should receive considerable attention. The matter of trimming trees has caused a great amount of trouble and annoyance to both property owners and station managers. We who are engaged in the business can see little or no reason why a person should protest at having his trees trimmed to allow the stringing of wires without coming into contact with the limbs, but how would it be if we owned the trees and were interested in the building of other people's property? Undoubtedly we would object to having our trees trimmed or poles set in front of our premises as much as they. In order to avoid trouble of this nature I would recommend the erection of poles high enough to bring the bottom wires well above the trees. This would, in a measure, remove the necessity of cutting trees and would at the same time insure a clear line free from grounds caused by wires cutting into limbs which are left in the way.

Recent orders received by our local company in Madison compelled them to remove all poles and wires from the four

streets bounding the Capitol Square. In order to do this the streets one block from the square were used for the new pole line. The trees on these streets were numerous and extremely large and tall, and in order to get above them it became necessary to purchase some unusually tall poles. Consequently poles were brought from Idaho, ranging from 55 feet to 75 feet long with 7-inch to 10-inch tops. These poles are very straight and when painted make a pole line that is worth going to see, and will undoubtedly stand the ageing test for years to come. Of course, these poles cost money; it also costs money to trim trees and keep them trimmed, so it is possible that in the end the long poles will cost no more than the shorter ones, and when it becomes necessary to string an extra circuit your men will not have their attention diverted from their work by a man or woman with a shotgun.

Stringing wires over buildings is bad practice, as you are liable to damage the roofs over which they pass. For instance, it is customary to build a horse to support a circuit which will be placed upon the roof and in time the water collects and rusts the tin under the legs. Leaks result and water causes damage to building and merchandise and the owner brings suit. This would not happen if all wires are carried on poles owned by the company. A few weeks ago the writer had occasion to visit the roofs of some of our stores and the sight was amazing. Some of the roofs were crossed and recrossed by a score or more of telephone wires. On account of the electric light circuit being entirely new in the district visited, its wires were found to be in excellent condition. The poles being tall and new, made it a good, substantial piece of property. However, in some instances, service wires are run too low and would thus interfere with the firemen in the discharge of their duty. In course these wires will have to be removed and this will cost money. When a service wire is to be run it would be well for the superintendent to visit the building and determine where and how it should be strung and thus be sure that it would not have to be removed on account of misjudgment.

Cross-arming poles is a very particular part of the construction of a good pole line. Great care should be taken to see that the gains are not cut too large in the poles, thus allowing the cross-arm to wabble. The lag-screw should be driven in only enough to give it a start, and turned in the remainder of the way. Cross-arms should be put on the side of the pole opposite the strain so that they will not be pulled off. In double-cross-arming, holes should be bored through the spacing blocks, which should not vary in length from the thickness of the pole at the gain, so as to prevent bending the cross-arm.

Arc-lamp poles should be 40 feet long and have at least 7-inch tops. These should be set with a 6-foot plank running edgewise under the top of the ground just far enough to be covered and square with the face of the pole, looking to the centre of the square. This plank will greatly strengthen the pole and prevent its top coming over by the constant strain of the arc lamp. When an order is given to put up an arc lamp in the outlaying districts, it is customary to rush the work and get the lamp to burning. The quicker it burns the sooner it becomes revenue. But how about the rush work? After the work is done it is found that the poles were not set in proper position. They are in or out of the proper line. It may not happen at the time the line is built, but a year or so afterward, when it is brought to your attention by the mayor or aldermen.

It will then be found necessary to do a part of the work over again, which proves the old adage that "Haste makes waste." In order to avoid this transplanting process, I would suggest that the proper authority—the city engineer, for instance—be made to stake out where poles could be properly set. It is reasonable to infer that if a city gives a company a franchise to use its streets to set poles in, that they will furnish some one clothed with authority to designate the proper location for them, or at least define curb lines, corners, gutters, etc. It is also better in laying out new lines to run them with a view to getting future business and not always by the shortest and quickest route. Often it is possible to run into a neighborhood that will give you a few customers that you were not anticipating. An electric line running past a man's house sets him thinking when nothing else would. We have been able to secure business after the line was up from parties who were not anxious for the light, but could not offer the absence of a pole line as an excuse for not wanting it. Whenever possible, it is undoubtedly best to set poles on lot lines or run in alleys and feed to the rear of the stores and houses. The neatest service wires you can put up do not improve the looks of a good piece of architecture and a bad-looking pole line makes a bad-looking street. Too much construction work is done simply for the time being and not with the demands of the future in view.

Consolidation articles were filed in Trenton, N. J., on December 20, merging several electric light companies of the northern part of New Jersey into the Central Electric Company, whose capital stock has been increased from $100,000 to $750,000. The companies merged are: the Raritan Electric Light and Power Company; the Bound Brook Electric Light, Heat and Power Company, the Dunellen Electric Light Company, the Edison Electric Illuminating Company, of New Brunswick; the Railway Electric Company and the Middlesex Electric Company. The officers of the consolidated company are: President, Philip N. Jackson; vice-president, Adrian Riker; secretary, L. D. Howard Gilmour; treasurer, Uzal H. McCarter.

Wall Street and the Electrical Stock Market.

On the New York Stock Exchange, General Electric closed the week at 186 bid and 189 asked, showing a loss of 3 points. The recent advance in General Electric stock to $200 per share has naturally resulted in the exchange of stock for the 5 per cent debenture bonds. To date about $3,600,000 bonds have been surrendered, leaving $1,700,000 outstanding. Metropolitan Street Railway, of New York, closed at 159¾ bid and 160¼ asked, indicating a loss of 10⅞ points for the week. Brooklyn Rapid Transit closed at 75¼ bid and 75½ asked, showing a loss of 1½ points. The annual meeting of the stockholders of Brooklyn Rapid Transit Company for the election of 13 directors for the ensuing year, and for the purpose of transacting such other business as may be duly brought before the meeting, will be held on Friday, January 25, 1901, at the office of the company, in Brooklyn, N. Y. Third Avenue Railroad closed at 120 bid and 122 asked, indicating a loss of 2 points. Manhattan Railway, of New York, closed at 112 bid and 112½ asked, showing a loss of 9¾ points for the week.

On the Boston exchange, American Telephone and Telegraph closed at 157 bid and no asked price quoted, showing a loss of 6 points in the bid price. Erie Telephone closed at 65 bid and 66 asked, indicating a gain of 12 points for the week. New England Telephone was not quoted.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Electric Company of America closed at 8¾ bid and 8⅞ asked, indicating a loss of ⅛ point for the week. Union Traction closed at 34⅛ bid and 34¼ asked, showing a loss of 1 point for the week.

On the curb, or outside market, in New York, Electric Vehicle closed the week at 14 bid and 17 asked, showing a loss of 2 points. Electric Boat closed the week at 28 bid and 29 asked, indicating a gain of ½ point. Consolidated Equipment closed at 11 bid and 11½ asked, showing a loss of ½ point for the week.

Wall street, January 19.

On January 1 all the property and franchises of the Mason City Electric Company, which owns the electric light and power, gas and hot-water heating plants in Mason City, Iowa, were purchased by W. E. Brice, of that city. During the coming year $50,000 will be expended in extensions and improvements.

Death of Professor Elisha Gray.

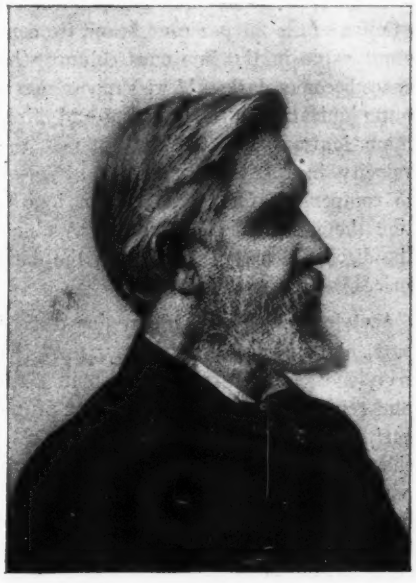
Professor Elisha Gray, the well-known electrical inventor, died suddenly at Newtonville, near Boston, on January 21, 1901. While walking in Newtonville Square he suffered an attack of neuralgia of the heart and fell unconscious in the street. He was picked up and carried into a neighboring house, where he died. Lately Professor Gray had been living with relatives in Newtonville and conducting experiments with an apparatus by which a bell could be rung electrically under water so that the sound might be heard a distance of several miles.

Professor Gray was best known to the public through his contention that the credit for inventing the telephone was due to him rather than to Professor Alexander Graham Bell. This incident was referred to by Mr. George C. Maynard in his article entitled "The History of the Invention and Development of the Speaking Telephone," which appeared in the ELECTRICAL REVIEW for January 12, 1901. Mr. Maynard states the circumstances attending the filing of Professor Bell's application for a patent as follows:

Early on the morning of February 14, 1876, Bell's application for a patent on his invention, which had been carefully prepared months before, was filed in the United States Patent Office. On the afternoon of that day the attorney for Elisha Gray sent to the Patent Office the amount of money required as a fee for filing a caveat, which, at that time, had not been written. The document was hastily prepared and rushed to the Patent Office just before the Department closed on that day. Gray's caveat did not describe an invention, but gave an indefinite explanation of what he hoped to invent. In the ensuing controversy, growing out of interference proceedings, and culminating in bitter legal battles and much newspaper discussion, it has often been stated that Bell's application was granted through some irregular or dishonest action on the part of Major Z. F. Wilbur, the principal examiner who had charge of the telephone cases. The statement is not true. Wilbur was then, and thereafter continued to be, hostile to Bell, whose patent was issued in March, 1876. It is much to the credit of Mr. Gray that he recognized and publicly declared that Bell, and not himself, was the first inventor of the telephone.

Professor Gray was a prolific inventor and had produced many electrical and mechanical devices, some of which brought him considerable money. Probably his best-known invention is that of the telautograph, which would reproduce writing at a distance.

Elisha Gray was born at Barnesville, Belmont County, Ohio, on August 2, 1835. As a boy he was a carpenter's apprentice, and later learned the trade of blacksmithing. His father was poor but the son managed to struggle through Oberlin College, where he took considerable interest in the sciences. His abilities as an electrical inventor did not develop until he was about 30 years old, when he invented the self-adjusting telegraphic relay which formed the basis for the improved relays now in use. Soon after he invented a telegraphic switch, an annunciator for hotels, a private telegraph line printer and a telegraphic repeater. In the early 70's he became interested in the transmission of sound by wire and filed a caveat on a proposed telephone as outlined above.



PROFESSOR ELISHA GRAY.

From time to time Professor Gray received comparatively large sums for his inventions, but invariably used the money in expensive experiments looking toward new discoveries. He died poor. Until recently his home was in Highland Park, near Chicago. He had a considerable collection of pictures, books and statuary, but he had found it necessary to dispose of these. At the World's Fair Congress of Electricians, Professor Gray served as chairman with Professor Hermann Von Helmholtz as honorary president.

Durant, in the Indian Territory, is to have an electric lighting and ice plant and work was begun upon it recently by the new company. The old light plant was shut down some time ago and the town will be in darkness until the new one is installed. The company promoting the plan was chartered under Texas laws with a capital of $20,000, most of the stock being owned by Bonham people.

NEGLECTED CONDUCTORS.

BY DR. LEONARD WALDO.

Twenty-five years ago, when galvanized iron wire had its widest vogue and copper line wires were getting a rapid start, some very sound principles of engineering were in use which, in the interval, have been lost sight of. Iron and steel wire were mechanically homogeneous in structure, and of such tensile strength that they permitted of long spans and comparatively small sag. With the complete advent of copper, its high conductivity and relatively low price, iron wire was rapidly displaced and copper wire took its place solely on the ground of high conductivity. A few engineers, such as Lazarre Weiller and Preece and, in our own country, Sprague, advocated in many forms of conductors where permanence of structure was of prime importance the use of copper in a modified state and accepted the best metallurgy of the time in using bronze wires where silicon or phosphorous was used as the means of deoxidizing the tin and copper used in its manufacture. Such bronze wires have obtained a small, relatively, use both abroad and in the United States, under the name of silicon-bronze and phosphor-bronze conductors. The manufacture of the silicon-bronze, which was better adapted to American manufacture and possessed a somewhat higher conductivity than the phosphor-bronze, was undertaken quite seriously by the Scoville Manufacturing Company, of Waterbury, Ct., in 1887. It put upon the market a series of conductors of all sizes, and designated as follows:

Name.	Per cent of conductivity of pure copper.	Tensile strength per square inch.	Twists in 6 inches.
Grade A	85	76,000	75
" B	43	80,000	110
" C	48	90,000	75
" D	43	100,000	60
" E	22	130,000	45
" F	22	150,000	30

This gave a complete range of conductors for telephone, electric light and trolley service. The sale of these wires in the United States was sufficient in these three forms of engineering to establish the mechanical excellence of this type of conductor. They remain to this day models of construction, and the overhead line wires for telephone service, for instance, maintain their position until the supports themselves give way in heavy storms of ice and wind.

It is known in the wire mills that the hardening which takes place in the outer part of wire drawn through dies is largely limited to a small percentage of the actual diameter of the wire. In copper con-

ductors, for instance, of certain sizes the very innermost parts of the wire are practically as soft as annealed wire. The action of the die in drawing the wire has been to compress the outside particles of the wire which form a circular arch for the protection of the inner parts of the wire from excessive pressure. Under the action of heat and cold in service (and our wires are subject to a change of temperature perhaps as much as 150 degrees between extreme Winter's cold and the direct sun of our hottest Summer day) the molecules of the compressed copper on the outside of the wire have a chance to readjust themselves in their uncomfortable and crowded position. The internal strains of the wire thus come into play, and the wire is gradually restored to a homogeneous condition, and the original tensile strength under which the wires were taut and things of beauty to look at has been replaced by the tensile strength of wire in a comparatively soft state.

In many of the forms of telephone engineering the capacity for long spans and the mechanical value of wires free from iron are of greater importance than high conductivity. With the advent of better telephone theory and the use of improved line devices, governing inductance and impedance, the value of high conductivity becomes less and the value of mechanical properties, which enable wires to be strung over long distances with the minimum of support, becomes greater. For instance, a wire with a tensile strength of 2,000 pounds would weigh per mile 270 pounds, and it would be possible to so adjust the catenary curve that the supports for such a wire could be one mile apart, in such an extreme case as the crossing of a river.

Science Brevities

Thoria Filaments—A patent recently issued to Carl Kellner, of Vienna, describes an incandescent lamp filament which is claimed to be a great improvement on the form at present in general use. It consists of a highly infusible metal, such as thorium in the form of a metallic powder, which is pressed by means of a mould into a thin thread. The surface of this metallic thread is now oxidized, thus forming a surface coating of thorium oxide, the substance which is the basis of the Welsbach mantle, over the conducting core. This oxide adheres firmly to the metal core, and when mounted in an ordinary incandescent bulb the passage of an electric current is said to give an extremely powerful light of low electrical cost.

Dark Cathode Space—By means of Graham's barometer tube and exploring wires, Mr. C. A. Skinner has determined the potential gradient in Faraday's dark space, says one of Mr. Fournier d'Albe's abstracts. This dark space shows an abnormally low value of the potential gradient as compared with the luminous column. The results obtained by the author in his endeavor to clear up this anomaly are, in many respects, identical with those obtained by Stark, and attributed by the latter to "ionic shooting." With increasing current, the Faraday dark space increases in extent, driving the luminous column before it. This is accompanied by a decrease in the gradient throughout the dark space. For the same current the amount of dark space decreases with increasing gas pressure. When the gradient falls 25 per cent below its constant value in the luminous column, the space becomes dark. If we suppose maximum ionization in the luminous and minimum ionization in the dark spaces, the velocity in the latter must be sufficient to compensate for the minimum ionization there, so that the conductivity along the discharge may be greater in the dark spaces, as the gradient requires.

Acetylene Lighting—Some interesting particulars respecting the growth of the acetylene gas industry are given in a recent report by the British consul at Stuttgart. Calcium carbide has been known to chemists as an interesting chemical compound for several years, but until recently it was practically unknown to the public. Now its production is one of the most important chemical industries. Germany was foremost to recognize the new illuminant, and it has secured the principal place in its production. At present there are at least 200,000 jets of acetylene gas in use in the country, and it is, the consul says, impossible to predict the result of the competition between it and its rival illuminants. Probably petroleum will suffer most; coal gas will be superseded to a great extent, especially in lighting small towns, but electricity will not be appreciably affected. No other branch of industry can point to such a large and steady increase in the number of patents, showing that it has encouraged great fertility of invention. Besides producing it at home, German capital has gone abroad to produce carbide, especially to Norway and Switzerland. One of the greatest successes of the industry has been its application to the lighting of railway carriages on German Government lines. During the current year the consumption of carbide in the country is estimated at 17,000 tons, equal in illuminating power to about 7,000,000 gallons of petroleum. Thirty-two small towns, with populations up to 5,000, are lighted by acetylene, and many more contemplate its adoption; and the progress of the system of lighting, says the consul, is "another striking instance of the manner in which the magnificent system of technical education has prepared the way for the introduction of new scientific achievements." The economic importance of the industry appears from the fact that Germany annually pays about £5,000,000 to the United States for petroleum, while acetylene is a purely German industry, carbide being manufactured in the country, which possesses in various parts all the necessary raw materials.

Electric Traction on the Orleans Railway, Paris—The *Chemin de fer d'Orleans* has adopted electric traction for the underground extension of four kilometres, which joins its Austerlitz station with a new station built on the site of the old Cour des Comptes. At the junction with the steam lines the various tracks are traversed by an electric transfer table nine metres long, capable of carrying either the electric or the steam locomotives. There are eight electric-driven locomotives, resembling the previous engines at Baltimore and Hoboken. They carry four motors on the four axles, with single-reduction gear, and are controlled by a series parallel controller with magnetic blowout. The locomotives normally take 500 kilowatts and weigh 40 tons, but can be weighted up to 46 tons to secure the extra adhesion necessary to draw a 250-ton train up a steep grade which occurs at one point on the line. Current is supplied through a third rail carried on paraffined blocks on the sleepers. The return current is through the track rails. The locomotives have three brakes in front and three behind. The central station, which supplies all the power and light, contains two 1,000-kilowatt, three-phase generators, giving 5,500 volts at 25 periods per second, and has room for a third set. The engines are of the horizontal type. The primary current is used direct only in certain constant-speed auxiliary motors. The line is fed from two substations containing stationary transformers and rotary converters, each giving 250 kilowatts at 550 volts. These converters are connected in parallel with a battery arranged to supply the extra current required during the short period of acceleration. The lights are chiefly in series on a 500-volt, continuous-current circuit, fed by six 100-kilowatt rotary transformers, driven by three-phase synchronous motors run from the 5,500-volt circuit. The accumulators (Tudor) are in two batteries, each having a capacity of 1,100 ampere-hours on a one-hour discharge. These batteries serve to equalize the load on the generating plant. The primary cables are armored triple concentrics laid in the ground or in masonry ducts.

Boston's Back Bay Electromobile Omnibus Line.

Some weeks ago an automobile omnibus service was instituted in the fashionable Back Bay district of Boston, Mass., by the New England Electric Vehicle Company. The object of this service was to supersede the old horse-car line and the system has thus far, as was briefly mentioned in a previous issue of the ELECTRICAL REVIEW, proven a decided success.

There are 10 of these omnibuses in operation, each running under a headway of 10 minutes from seven in the morning until after theatre time at night. This service was started in answer to the request of a large number of residents in the Back Bay district for a convenient means of transit, and more commodious omnibuses will be put on as soon as the occasion warrants. Each of the omnibuses now in operation has accommodations for 10 passengers inside and room for one outside with the driver, as will be seen by the accompanying illustration. In addition to the driver there is a conductor. The Boston *Herald*, commenting editorially on the new service, said: "The Back Bay horse cars have gone but the Back Bay automobile omnibuses have arrived. We are thus kept in touch with our great fashionable centre."

A BOSTON ELECTROMOBILE OMNIBUS.

Capitalists by the name of Ford, from Wyandotte, Mich., wish to purchase Detroit's electric lighting plant and are said to have guaranteed to make a price of 10 cents per 1,000 watt-hours for the discount if the purchase is allowed.

New Turbines for the Niagara Falls Power Company.

The I. P. Morris Company, of Philadelphia, has been awarded the contract for the construction of six new 5,000-horse-power turbines by the Niagara Falls Power Company. As the I. P. Morris Company built the 10 turbines now in use in the present big wheel-pit at the Falls, it is generally familiar with the requirements of the Niagara conditions. The new turbines are to be patterned after designs prepared by Escher, Wyss & Company, of Zurich, Switzerland. The present turbines were after designs made by Piccard, Pictet & Company, of Geneva, Switzerland. It has been intimated heretofore that the wheels for the new pit would differ somewhat from those now in use, and the official news confirms this early statement. The principal point of difference will be in that the gates and buckets will be enclosed in the wheel case and there will be draft tubes which will permit the utilization of the full available head. The I. P. Morris Company will deliver the new turbines in August of the present year, when they will be used to drive the six 5,000-horse-power generators ordered last November from the General Electric Company. The plans of Escher, Wyss & Company were accepted by the Niagara Falls Power Company as the result of a competition invited after Dr. Coleman Sellers and Mr. William A. Brackenridge returned from Europe last Spring.

PERSONAL.

Mr. Joseph E. Lockwood, president of the Michigan Electric Company, Detroit, visited New York city this week.

Mr. H. D. Critchfield, the well-known independent telephone man of Cleveland, Ohio, was among the visitors to New York city this week.

The following gentlemen have been made chevaliers of the Legion of Honor, in connection with the Paris Exposition of 1900: George Westinghouse, Carl Hering and Francis E. Drake.

The resignation of John H. Peck as president of the Rensselaer Polytechnic Institute, at Troy, N. Y., was accepted on January 16 by the trustees of the institute, and a committee of three, comprising Horace G. Young, of Albany; Charles MacDonald, of New York, and Harry B. Dauchy, of Troy, was named to report on a successor. The report will be presented at the meeting of the trustees on February 6.

Mr. James R. Chapman, electrical engineer for the Union Traction Company, of Chicago, has been employed by Charles T. Yerkes, the street railway magnate, to superintend the construction and equipment of his underground railway system in London. Mr. Chapman has been identified with the construction and equipment of practically all the surface electric lines on the North and West Sides, as well as the Northwestern and Union elevated roads in Chicago.

New York Electrical Society.

The date for the two hundred and eleventh meeting of the New York Electrical Society, which, by courtesy of the New York Gas and Electric Light, Heat and Power Company, will be held at the Edison station on Duane street, was changed from January 16 to January 30, on account of the illness of Dr. Louis Bell. This meeting is to be one of the society's "Ladies' Nights." Dr. Bell's subject is: "Electric Illumination at the Beginning of the Twentieth Century." Electric coffee will be served.

A charter has been granted to the Central Rapid Transit Street Railway Company, of Scranton, Pa., incorporated by Hon. W. J. Lewis, president; C. D. Jones, vice-president; John H. Brooks, secretary and treasurer; W. H. Watson and Edwin H. Gearhart. A franchise will be asked for from the Scranton city council and it is stated that the company hopes to build a double belt line around Scranton. In case the franchise is granted work will be commenced at once.

Views, News and Interviews

Golf enthusiasts are now playing the game at night at Miami, Fla. A short approaching and putting course has been laid out on the hotel grounds. It is illuminated every night by electric lights.

An observant reader of the ELECTRICAL REVIEW recently discovered the following item in a paper published in the rural districts of New York: "The Prince of Wales is said to be greatly pleased with our American horseless radish raised at Quogue, L. I."

Fire completely destroyed, on January 18, the building owned and occupied in part by the Pope Manufacturing Company, in Washington, D. C., causing a loss of about $100,000. The building was erected at a cost of $87,000 and was designed as a model showroom for bicycles. The Columbia company used the first floor, and the two upper floors were occupied by a pension and patent attorney. All of the papers in some 20,000 cases were lost. The Columbia company lost about 100 bicycles, all of its plant, and several automobiles. A feature of the fire was the daring rescue of three automobiles by an employé of the company, who dashed into the first floor when it was full of flames and smoke, and ran the machines out one at a time through the fire and into the street, using their own power.

English press despatches of January 19 state that a few days ago the Dover-Ostend mail packet Princess Clementine went ashore off Maria Kerke in a fog. Her wireless telegraph apparatus was at once put in play to summon assistance from Ostend, which came in a short time. The little steamer was floated off at high water and arrived in safety at her destination.

The first systematic attempts of the United States Weather Bureau to ascertain exactly the amount of yearly damage done by lightning in this country were begun in 1898, and the statistics for 1899 have just been published by the bureau. The figures show: The number of buildings damaged or destroyed by lightning in 1899 was 5,527; in addition to these, 729 buildings caught fire as a result of proximity to other structures that were fired by lightning. The approximate loss in 2,825 cases was $3,016,000. In 3,431 cases the amount of loss was not reported, owing, undoubtedly, in a majority of instances, to the fact that it was very small. The report says that a conservative estimate of the total loss by lightning during the year would be $6,000,000. It is noteworthy that the great majority of buildings struck by lightning were not provided with lightning rods. This was also the case in 1898. On the other hand, 70 buildings provided with rods were struck and damaged in 1899.

Fire recently destroyed the electric light plant of Texarkana, Ark., the loss amounting to about $15,000. Another plant is now under construction and it is expected to be finished by February 1.

The rival electric companies of Colorado Springs, Colo., which have heretofore been bitterly opposed to each other, have at last come together and a contract has been entered into between them whereby the Citizens' Light, Heat and Power Company is to be furnished with power for a number of years by the Colorado Springs Electric Company.

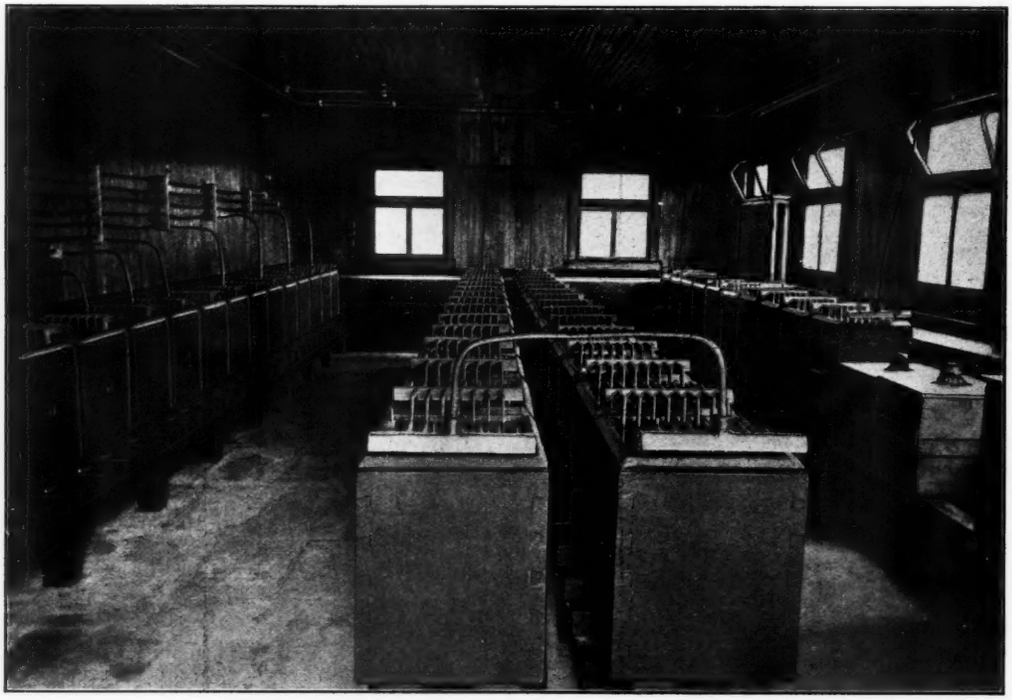


FIG. 1.—AN ACCUMULATOR INSTALLATION IN A PRIVATE RESIDENCE—VIEW OF THE BATTERY ROOM.

New York and Chicago capitalists who recently purchased the two gas and electric light plants at Youngstown, Ohio, and are building the Youngstown & Sharon Electric Railway, have closed negotiations for the Sharpsville Electric Light Company's plant. The same parties will build an electric road from Sharon to South Sharon, which will ultimately be extended to New Castle.

The city council of Montpelier, Ind., has voted to purchase the plant of the Montpelier Light and Water Company for $38,000. The plant now belongs to Kerlin Brothers, of Toledo, Ohio.

An Accumulator Installation in a Private Residence.

During recent years the installation of electric lighting plants in country houses of the better class has rapidly extended in this country, and to-day the equipment of some of them leaves little to be desired in perfection of design and installation.

The accompanying illustrations represent the engine and dynamo room and the storage-battery room in an installation recently put in at the country house of Mr. Archibald Rogers, at Hyde Park, N. Y. In the residence and stables are 400 incandescent lights and five motors, ranging from one-half up to two horse-power, and used for a variety of purposes, including pumping water and operating tools in a small machine shop. The engine room is well shown in Fig. 2. The generator is a shunt-wound multipolar machine, giving 200 amperes at from 100 to 150 volts; no booster is used, this variation in voltage being sufficient for battery-charging purposes. As the illustration shows, the generator is direct coupled to a horizontal high-speed engine giving 60 horse-power at 300 revolutions per minute. Steam for the engine and for heating the premises and laundry purposes is supplied by a battery of three horizontal return tubular boilers of 50 horse-power each. The engine room is further equipped with the white marble switchboard shown in the background of the illustration, upon which are grouped all of the instruments and switches necessary to operate generator, battery and feeders.

The battery room is constructed of stone to a height of four or five feet above the ground, the side walls above this point being of heavy double-frame construction. The numerous windows are connected together by means of an iron shaft, so that they may all be opened simultaneously to permit ventilation. The floor of the battery room is of heavy stone flagging with Portland cement joints. In one corner of the room a drain leads to a three-inch tile pipe.

The battery consists of 55 cells of chloride accumulator, made by the Electric Storage Battery Company, of Philadelphia, and has a capacity of 1,200 ampere-hours at the normal discharge rate. Each cell is composed of 15 plates, each about 15½ inches square, suspended in lead-lined wooden tanks in the usual way. The battery is all in one tier, as the illustration shows, and rests upon glass insulators supported by wooden stringers. A floor space of 20 by 40 feet is occupied. The wiring of the battery terminals and end cells proceeds to the engine room through a duct consisting of a six-inch tile pipe, each wire being protected by a circular loom conduit. In the battery room proper all the wiring is run upon porcelain insulators. The switchboard is arranged so that the generator can supply light and power at the same time that it is charging the battery. When charged, the battery can be used alone to supply light and power, or it can be thrown in parallel with the generator during hours of unusual load.

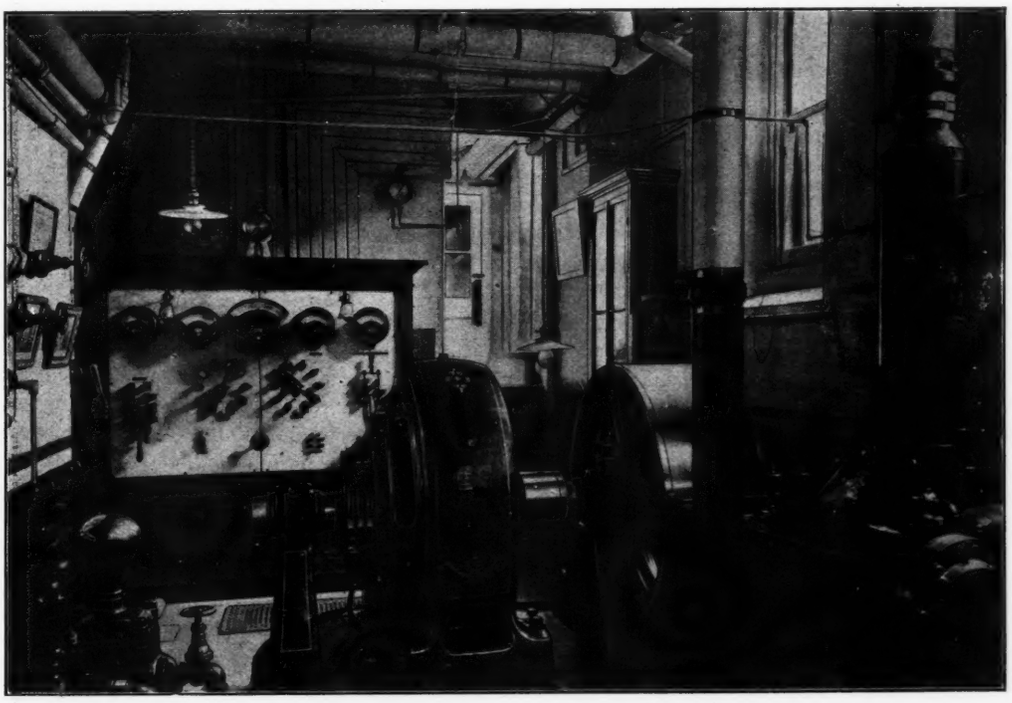


FIG. 2.—AN ACCUMULATOR INSTALLATION IN A PRIVATE RESIDENCE—ENGINE ROOM AND GENERATOR.

Presentation of a Silver Cup.

The Olympic Club, of New York city and Bay Shore, L. I., comprises among its members a very large proportion of gentlemen who are engaged in electrical pursuits. Its president is Mr. James Kempster, one of the leading printers of New York. At the annual meeting of the club, recently held, the members gave Mr. Kempster a magnificent loving cup suitably engraved. The testimonial was presented with many expressions of regard and esteem which the members have for Mr. Kempster, who has so admirably conducted the affairs of the club for the past two years as to greatly advance its interests and increase its membership.

A New Electric Lighting Company in Denver.

A special aldermanic meeting was called for the night of January 21 by the mayor of Denver, Colo., to consider the granting of a new ordinance to the Lacombe Electric Light Company, permitting that company to use the public streets for its wires and cables. A similar ordinance has already been passed, but on account of a ruling of the court that publication was not properly made it was decided to avoid all possibility that the case would be taken to the Supreme Court, by having a new ordinance passed and regularly published. The expense of publication will be borne by the company, as the mistake was made by its attorneys.

Electric Lighting

St. Edward, Neb., has its new electric light plant completed. It was put in operation in the week of January 1.

The city council of Painesville, Ohio, is figuring on selling the municipal electric light plant, which is said to be a failure.

Prominent business men of Wellsville, Ohio, are said to desire a new electric light plant and a joint stock company is talked of.

Plans are being prepared at Tacoma, Wash., for an electric lighting plant and the city may establish its own electric station in the near future.

A municipal electric lighting plant is proposed for Midland, Md., at a cost of about $8,000 and a capacity of 1,200 16-candle-power incandescents.

A new electric lighting plant was formally opened in Hutchison, Minn., on December 20. The plant is owned by a local company and cost $18,000.

A new 1,500-light dynamo has recently been installed in the electric lighting plant at Milford, Me., practically doubling the capacity of the old dynamo.

Extensions are planned for the plant of the Lebanon, N. H., Electric Light and Power Company, the present system making demands upon the plant which can not be met.

A petition has been presented to the city council of Lowell, Mass., regarding the purchase of the Lowell Electric Light Company, which it is expected will be run as a municipal plant.

The city council of Knightstown, Ind., has purchased the electric lighting plant of the old company for $2,000 and will operate it until a new one can be erected, which will be as soon as possible.

A $100,000 electric light plant is to be constructed in Philadelphia, Pa., by the Girard estate, to supply its tenants in the eastern part of that city. The plant will not be for general but for private use.

If present expectations are fulfilled Crossville, Tenn., will have an electric light plant in operation by the middle of February. And the municipal plant at Jackson will be constructed in the near future.

The Citizens' Light and Power Company, of Rochester, N. Y., has let contracts for the erection of a power-house and office-building on the site of the one recently destroyed by fire, and the machinery for the new plant is now almost installed.

Bids were opened on January 1, in Richmond, Ind., by the city council for the construction of a municipal light plant, but were all rejected. The highest bid was $159,250 and the lowest, $150,600. Bids have been again called for.

W. E. Bryce and his associates have purchased the plant and good will of the Mason City, Iowa, electric light, gas and heating plant for $100,000 cash. Mr. Bryce's colleagues are interested in the local electric railway.

Waterloo, Ill., has purchased the electric light plant from the local company, paying for it in instalments at the rate of $1,220 per year for seven years. Heretofore the city has paid $133 per month for street lighting.

A special electric arch is reported in the Mexican *Herald*, of December 25, as one of the plans of the electric light company at Pueblo. The arch will be erected and illuminated in honor of the visit of President Diaz to that city.

The plant and repair shops of the Delaware & Hudson Railroad Company, at Troy, N. Y., are to be lighted by electricity, a large dynamo having been received there and a complete new electric light plant will shortly be installed.

The board of public works of Ansonia, Ct., has recommended that the board of aldermen be empowered to issue a $100,000 bond for a municipal electric lighting plant and that all overhead wires be taken down and replaced in a subway.

At a recent meeting of the new Consolidated, Wabash, Iowa, Water and Electric Light Company directors were elected. The officers of the company are R. B. Dodson, president; W. Snow, secretary; C. T. Backus, treasurer, and Thomas W. McManee, superintendent.

More electric lights are soon to be placed in Buffalo's parks. The matter was agitated in connection with the Pan-American Exposition, and it is believed that the portions of the parks which are now dark and where many accidents have occurred will be lighted in the near future.

Capitalists of Wilkesbarre, Pa., who recently purchased a controlling interest in the Muskegon street railway and the gas plant, have recently obtained a controlling interest in the electric lighting plant also. The electric lighting company is capitalized at $65,000 and is bonded for $33,000.

Pledges for bonds which are to be issued to raise the money necessary for enlarging the city electric lighting plant of Paducah, Ky., have been so generously subscribed for that only one-fifth of the necessary amount is uncalled for. It is expected that this will be taken in the near future.

President W. A. Scott, of the Springfield, Ohio, Light and Power Company, stated recently that his company would accept the offer of $73 per light made by the board for street lighting of that city. The contract is for 10 years from January 2, and at present the city uses 260 arc lights.

A special election was held in Gowanda, N. Y., on January 5, to determine the contract for lighting that village by electricity. The contract was awarded to the Gowanda Agricultural Works Company, this bid being $1,250 less than the bid of the Gowanda Electric Light Company.

The water and electric lighting systems of Wabash, Ind., were consolidated on January 1, both properties being owned by the First National Bank of New York city, which purchased the lighting system last Fall. The company has 1,500 consumers and a gross income of about $20,000.

Sturgis, Mich., has two electric lighting companies and the city council has recently appointed a committee to confer with the Citizens' Electric Light Company for the purpose of buying out the plant. The two plants now in operation are the municipal plant and the Citizens', and neither one is paying expenses.

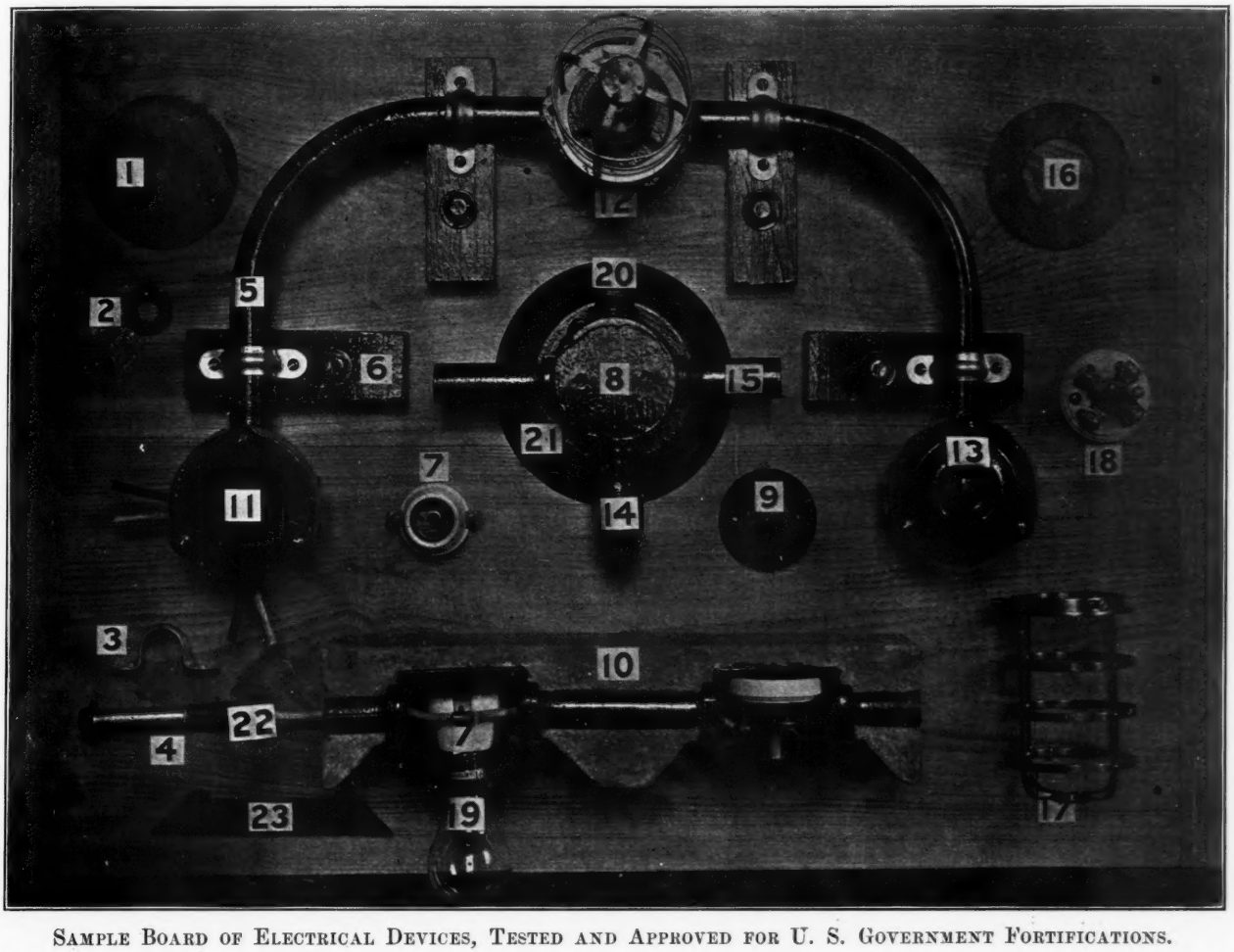
New electric light plants are said to be contemplated for the following cities: Yellville, Ark.; Port Austin, Mich.; Bisbee, Ariz.; Lincoln, Ill.; Mantorville, Minn.; Madison, Me.; Crossville, Tenn.; Echo Post Office, Long Island, N. Y.; Pawtucket, R. I.; Pratt City, Ala.; Monroe, La.; Braymer, Mo.; Coldwater, Ont.

At a recent meeting of the board of public improvements in New York city, there was a long discussion concerning proposed ordinances making it a misdemeanor to hang electric lights in front of stores less than nine feet from the sidewalk. The ordinances were approved and are to be returned to the municipal assembly.

A friendly suit has been agreed upon in Hempstead, L. I., to establish the validity of the $100,000 bond issue for an electric light and water plant. The question to be determined is the form of the resolutions to be voted on—whether there should have been separate resolutions so that the people should have had an opportunity of adopting one scheme and rejecting the other.

Electrical Appliances for United States Army Use.

The accompanying illustration is made from a photograph of a sample board made up for Lieutenant R. R. Raymond, of the United States Army Engineer's office, at Boston. Upon the board are represented a number of the different electrical appliances tested and accepted by the government for use in all of its fortifications on the New England coast. As is well known, work of this character is necessarily of the most substantial and solid variety so as not to be damaged by gun fire in its neighborhood, and also is required to be as certain in its operation as such things can be because of the vital importance that it shall work when called upon to do so. The list of apparatus mounted upon the board given under the illustration is a sufficient explanation of the type and class of the various apparatus that has been selected after careful experiment and trial for this important purpose.



SAMPLE BOARD OF ELECTRICAL DEVICES, TESTED AND APPROVED FOR U. S. GOVERNMENT FORTIFICATIONS.

1. Rubber gasket, $\frac{1}{16}$-inch thick, $3\frac{7}{8}$ inches diameter, for use on a junction or switch box.
2. Rubber ring for neck of lamp.
3. Galvanized iron-pipe clip.
4. "Evans," style 18, expansion bolt, 4-inch by $\frac{5}{8}$-inch.
5. "Loricated" conduit elbow, $\frac{3}{4}$-inch.
6. Cedar cleat, $5\frac{1}{2}$-inch by $1\frac{3}{4}$-inch by 1-inch.
7. Porcelain receptacle (General Electric No. 9171) with copper terminals and shell (Verdigris will not form on a copper shell but will on a brass shell).
8. Represents an iron box placed on wooden block No. 21, for the purpose of recessing the box in concealed work, shown in section in Fig. 10. A section of the wooden block is shown in Fig. 23.
9. Hard rubber base for use in attaching receptacle No. 7 to iron box.
10. Concrete block which shows in section the manner in which the conduit, lamp box, junction box and switch boxes are installed in concealed work. All of the conduit work is in place *before* the concrete is put on the ceiling.
11. Junction box complete.
12. Lamp box complete with lamp and guard.
13. Switch box complete.
14. Conduit coupling, $\frac{3}{4}$-inch.
15. "Loricated" conduit, $\frac{3}{4}$-inch.
16. Rubber gasket for lamp box.
17. Bronze cage or guard.
18. Double-pole "Hart" switch, 10 ampere, with special switch key and binding-posts, terminals being on tops of posts, instead of on sides as usual, to facilitate making connections when in box.
19. Sixteen-candle-power 110-volt "Shelby" tipless lamp, with porcelain insulating button in base of lamp. This lamp is designed for paper mills and other damp places. Wires enter lamp in separate tubes.
20. Iron plug to close holes in boxes not required.
21. Wooden block (or form) for use in concealed work to make a recess as shown in Fig. 10.
22. Circuit wires of different colors (black and white). The shells of the receptacles are all connected to one color, and the inside contact to the other color; in this way it is impossible to get a short circuit in changing lamps as all of the shells of all lamps have the same polarity.
25. Section of wooden block (Fig. 21) used as a form for concealed work.

The Cycle Show in Madison Square Garden, New York City.

Several new types and designs of automobiles, autocycles and trimotors were exhibited at the cycle and motor show held at the Madison Square Garden last week. A track in the basement of the garden had been prepared for illustrating the operation of the vehicles, and considerable attention was attracted to the operation of the autocycle, which, it was claimed, could attain a speed of 30 miles per hour, its total weight being only 75 pounds, including the complete equipment.

The American Bicycle Company exhibited a complete line of its electric vehicles, and a new trimotor capable of seating two persons. The main feature of the trimotor is that the gear, etc., are on the front wheel, while the steering lever is so connected that it may be used to regulate the speed of the vehicle.

Several firms exhibited motor tricycles for pacing purposes and claimed that they could attain a speed of 35 to 40 miles an hour or even more on a good track.

Grout Brothers, of Orange, Mass., had on exhibition a new electric runabout, built to run from 40 to 50 miles without the necessity of recharging.

Capitalists are said to be negotiating for the purchase of the Shenandoah, Pa., electric light and gas plant and the Mahanoy city plant. A line will be built between the two towns to light the intermediate district. Wilkesbarre capital is said to be behind the plant.

Corporation News

TRENTON, N. J.—Fayette Home Telephone Company. $250,000.

ALBANY, N. Y.—Ithaca Electric Company, Ithaca, N. Y. $50,000.

ALBANY, N. Y.—Bath & Cameron Telephone Company, of Bath. $400.

INDIANAPOLIS, IND.—Cambridge City Light and Power Company. $3,000.

COLUMBUS, OHIO — Consolidated Ice and Electric Company, Cambridge. $100,000.

HARRISBURG, PA.—Merchants' Electric Light, Heat and Power Company, York; $1,000.

JACKSON, MISS.—Laurel Light and Power Company. $10,000. Andrew Flanagan and others, incorporators.

LANSING, MICH.—Detroit, Mt. Clemens, Romeo & Armada Electric Railway. $25,000. Secretary, Frank E. Mellis.

WATERLOO, QUEBEC, CANADA—Brome Rock Electric Power Company. $5,000. W. S. Foster and others, incorporators.

ALBANY, N. Y.—Cattaraugus Telephone Company; $1,000. Colonial Telephone Company, of Newburgh; $125,000.

SACRAMENTO, CAL.—Mammoth Power Company, of Hanford. Incorporators: H. J. Lucey, J. S. Eastwood and others.

NASHVILLE, TENN.—Crossville Electric Light and Power Company. $2,000. Incorporators: J. B. Johnson and others.

TRENTON, N. J.—Wenonah, Glassboro & Clayton Railway Company. $50,000. Ernest H. Boynton and others, incorporators.

TRENTON, N. J.—Freehold Electric Light, Heat and Power Company. $10,000. H. F. Weeks and others, incorporators.

ST. PAUL, MINN.—John Haug, of Faribault, has been appointed receiver for the Faribault Consolidated Gas and Electric Company.

SPRINGFIELD, ILL.—West Sangamon Telephone Company, of Pleasant Plains. $2,500. John M. Howard and others, incorporators.

MILWAUKEE, WIS. — The Plymouth Telephone Exchange has been recently chartered as a stock company and directors have been elected.

OLYMPIA, WASH.—Ideal Light and Power Company, Spokane. $30,000. H. M. Layne, of Butte, Mont., and others are the incorporators.

DOVER, DEL.—Maryland & Delaware Telephone and Telegraph Company. $50,000. Incorporators of this company are Baltimore capitalists.

ELLICOTT CITY, MD.—The Ellicott City Power and Electric Company's plant has recently been sold to George L. Mowen, of Baltimore, for $1,950.

TRENTON, N. J.—Missouri River Power Company, of Jersey City. $20,000. Incorporators: S. T. Hauser, Helena, Mont., and H. Suhr, East Orange, N. J.

CHARLESTON, W. VA.—Monongahela Railroad Company, of New York city. $50,000. Incorporators: James A. Milholland, Cumberland, Md., and others.

DOVER, DEL.—Telephone Company of America, Washington, D. C., to manufacture telephones and supplies and to operate machine shops and foundries. $5,000,000.

SPRINGFIELD, ILL.—General Pneumatic Company, Chicago, to supply electric power and manufacture vehicles, motors, etc. $25,000. T. P. Kerrigan and others, incorporators.

BELLOWS FALLS, VT.—The Bellows Falls Electric Light Company has been recently reorganized under Vermont laws with a capital of $100,000. It has operated heretofore under a Maine charter.

PITMAN GROVE, N. J.—The Wenonah, Glassboro & Clayton Electric Railway Company has recently purchased the plant of the Gloucester County Electric Light Company. The purchase price is not known.

ALBANY, N. Y.—John S. Bushnell Company, to manufacture electrical and steam appliances. $25,000. Directors: A. C. Lippincott, of Newark, N. J., and J. H. Spencer and H. Hartt, of New York city.

TRENTON, N. J.—Chikasha Water, Light and Telephone Company, of Chikasha, Mays Landing. $100,000. Incorporators: J. W. Avery and O. Congleton, of New York, and H. J. C. Thornton, of Cranford, N. J.

ALBANY, N. Y.—Ossining Heat, Light and Power Company. $250,000. Incorporators: J. B. Summerfield, A. L. White, both of Brooklyn; J. M. Mitchell, of New York city; Davies, Stone & Auerbach, attorneys, New York city.

ALBANY, N. Y.—Capital County Light, Heat and Power Company, of Watervliet; $25,000. Subscribers' Telegraph and Telephone Company, also of Watervliet; $15,000. United States Electric Contracting Company, of Syracuse; $40,000.

BIRMINGHAM, ALA.—The Birmingham Railway, Light and Power Company has recently filed a blanket mortgage covering all its property, real and personal, for $3,500,000. The papers are made out to the Old Colony Trust Company, Boston, Mass.

LONDON, ENGLAND—Crown Electric Heating Syndicate, Limited; £5,000. J. & E. Hall, Limited; £250,000; to carry on business of electrical, mechanical and marine engineers. British Electric Railways, Limited; £1,000. Holden Motor Patents Syndicate, Limited; £10,000.

VALLEY STREAM, L. I.—Current rumors state that the plant of the Suburban Electric Light Company has been sold to a syndicate of capitalists who will operate it. The policy of the company is as yet unknown, but it is believed that a new contract will be made with the officials of Hempstead as the greater part of that township is now dark.

RALEIGH, N. C.—The American Telephone and Telegraph Company has been incorporated, with a capital stock of $15,000, and privilege of increasing to $100,000, for constructing and operating lines of telephone and telegraph. Edward J. Hall, of Morris Township, N. J.; A. B. Andrews, Jr., of Raleigh, N. C.; Melville Egleston, of Elizabeth, N. J., and others are the incorporators.

IRONTON, OHIO—The Ohio Valley Electric Railway Company has been succeeded in name by the Camden Interstate Railway Company, recently organized at Huntington, W. Va.—for $1,000,000—to operate an electric line from Guyandotte, W. Va., to Hanging Rock, Ohio. The officers of the new company are J. M. Camden, Jr., president; Sprigg Camden, secretary, and A. Caldwell, treasurer.

FORT SCOTT, KAS.—The Fort Scott Electric Light and Power Company, the Citizens' Street Railway Company and the Fort Scott Steam Heating Plant have been consolidated under a new charter and the combination will be known as the Fort Scott Consolidated Supply Company. Its capital stock is $250,000, held by the stockholders of the old companies. The officers are Grant Hornaday, president; C. F. Martin, vice-president; F. A. Hornaday, secretary; F. D. Martin, treasurer. The following board of directors has been elected: Grant Hornaday, C. F. Martin, F. A. Hornaday, E. C. Gates, Chas. H. Gardiner and C. R. Messenger.

COLUMBUS, OHIO—The Chagrin Falls & Eastern Electric Railroad Company has recently increased its capital stock from $300,000 to $500,000. The stockholders of the Sandusky & Interurban Electric Railway Company in executive session recently voted to extend their lines to Norwalk and South Amherst. Mansfield, Mt. Gilead & Columbus Electric Light and Power Company; $20,000; T. Y. McCray, J. F. Boals and others, incorporators. Norwalk, Ashland & Southern Railway Company, Norwalk; $10,000; incorporators: C. P. Wickham, J. C. Curtiss and others. Buckeye Traction Company, Bucyrus; $10,000; A. J. Scott and others, incorporators. Reports from Cleveland state that the Northern Ohio Traction Company has recently purchased the Akron & Cuyahoga Falls Rapid Transit Company for about $500,000. Northern Ohio Electric Railroad Company, to build a line from Defiance to Bram; $25,000. United Power Company, East Liverpool; $900,000. Mechanicsburg Telephone Company; $25,000.

Electric Lighting for Railway Cars in Germany.

The recent report of United States Consul-General Frank H. Mason, of Berlin, dated December 14, 1900, in reference to the lighting of railway cars in Germany, has attracted a good deal of comment, particularly among the railway journals. The report is of importance as giving a conservative review of the question of lighting railway trains, and it is presented here for the first time in full:

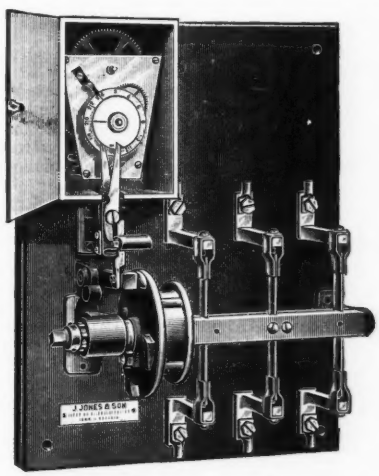
The recent deplorable railway accident at Offenbach-on-Main has led to a sharp and thorough inquiry into the danger which may attach to the illumination of railway passenger cars by means of gas and the greater comparative safety of electric lighting. The accident referred to was a collision between the rear car of a vestibule express train backing to repass a block signal which had been overrun in a thick fog and the engine of a local passenger train which was following the express. The engine crushed its way through nearly half the length of the car, killing many of the passengers in the five rear compartments, of which the car comprised 10, all opening into an aisle or passageway along the side of the carriage.

In this crush the chimney of the engine was cut away and the front of the boiler so broken in that the smoke and flame from the flues poured out into the wrecked car.

The passengers in the front sections of the car escaped by the door and windows; but before aid could reach the survivors in the rear ones there was a loud and powerful explosion, which tore the wreck to splinters, set the interior on fire, and sealed the fate of those who still remained alive. This was the original and generally accepted account of the affair, although the railway officials have claimed, and the official report tacitly admits, that the explosion occurred later, and when the whole interior of the wrecked car had been set on fire by the engine and was all ablaze, the point of contention being that the explosion did not of itself increase the loss of life.

However this may have been, the explosion did occur, and its nature and origin are thus explained: The car was lighted by what is known as the Pintsch system, and the supply of gas was carried in two cylinders of galvanized-iron plate about 12 feet in length which hung lengthwise beneath the floor at the middle of the car. In the collision both these cylinders were torn loose from their fastenings and thrown into transverse positions across the track, still beneath the car. Neither cylinder exploded, but the gas from their torn connections rushed out and filled the car above, forming in a few moments a mixture of gas and air, which being ignited by fire from the engine exploded with the result above described.

The question of the moment is whether the Pintsch system of gas lighting for passenger cars, which has been, during recent years, practically universal on the state railways of Prussia, should not be replaced by electric apparatus, and this theme the technical press is now discussing with great energy and earnestness. Under this system, rich coal gas, rendered still more luminous by a 25 per cent admixture of acetylene gas, is compressed into cylindrical reservoirs and burned in specially devised lamps by burners which automatically adapt the flame to the varying pressure in the cylinders. In itself this enriched gas is not explosive, but it naturally forms an explosive mixture when combined with a certain percentage of atmospheric air. The system has been recognized as a great improvement over the stearin candles, colza oil, kerosene, and other lamps which had been previously



A Clock-Controlled Switch.

used, and was regarded as satisfactory until electric lighting came into general use in streets and buildings. About 10 years ago experiments were begun on the express trains, Frankfurt-Bebra and Stuttgart-Halle, with an electric system in which a small dynamo, placed in the baggage car and geared to an axle of the running gear, generated electric current at a voltage sufficiently above the point of utility to give a surplus which charged a small storage battery, that supplied the lamps when the train was not in motion. This worked so satisfactorily that in 1893 electric lights were adopted for the postal cars, of which there are about three thousand in use in this country.

A postal car requires for ordinary service the illumination afforded by about fourteen full gaslights, which latter not only consumed rapidly the oxygen in the car, but in Summer heated it to such a degree that, what with heat, vitiated air, and varying light supply, the comfort, health and eyesight of the employés were seriously compromised. For this reason, the electric light has become all but universal in the postal cars of Germany, each of which either carries its small dynamo and accumulator, and thus operates independently, or is provided with storage batteries, that are charged from an outside source before the car begins its journey. The storage battery used for this purpose is of a type known as the Böse accumulator, four of which, each containing eight cells, carry sufficient energy to supply nine to eleven 12-candle incandescent lights during two nights.

Although this system, as well as the self-generating apparatus used in the two express trains above cited, has worked satisfactorily, it is recognized that the general substitution of electricity for gas in railway lighting throughout Prussia would involve not only large expenditures, but several important technical difficulties. To discard wholly the Pintsch system would mean throwing away an immense store of costly apparatus and the purchase of an entire new outfit, in which no part of the old material could be used. During the period of transition, when part of the cars in a train would be equipped with gas and part with electricity, difficulties would occur which would be especially serious in Germany, where so many trains do not make their entire run intact, but are cut into sections for branch lines at one point and reassembled or added to at another. In the management of postal cars, which are loaded at the point of departure and make a uniform through run without change, the loading and unloading of charged and exhausted storage batteries involves no difficulty, but this is not the case with passenger cars.

Experiments are now being made on a train between Berlin and Cologne with the Stone system of electric lighting, in which each car carries a small dynamo geared to a wheel axle and an accumulator, both hung beneath the floor of the car. This system has proved successful in England; but it is claimed here that the varying speed and stoppages of the train cause variations and unsteadiness in the light, which the accumulator does not successfully correct. Finally, the instances where gas has proved a source of actual danger in accidents have been so rare and its use has been on the whole so satisfactory that, in view of the cost and technical difficulties which a general substitution of electrical lighting would involve, expert opinion is still divided as to the wisdom or necessity of such a change.

Clock-Controlled Switches.

The accompanying illustration represents an ingenious switch recently placed on the market by Messrs. J. Jones & Son, New York, in which a clock so controls the movement of the switch blades as to throw on and turn off the current at any designated time once in each 24 hours. The clock movement is of the eight-day character, requiring winding once a week only. The switch is manufactured to work up to 200 amperes on either direct or alternating circuits, and the apparatus is so constructed that no part of the current enters or affects the clock in any way.

Industrial Notes

THE ELECTRIC APPLIANCE COMPANY, Chicago, is advertising its new line of "Eaco" jack-knife switches.

THE ALBERTYPE COMPANY, 250 Adams street, Brooklyn, N. Y., has sent to the ELECTRICAL REVIEW two examples of its work in the form of calendars depicting Cuban scenes.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is sending out, with its compliments, a neat and attractive daily-reminder desk calendar for 1901.

THE CHICAGO EDISON COMPANY'S repair shops at 76 Franklin street, Chicago, Ill., remain open day and night for the repairs of all classes of electrical machinery. The equipment in all shops is of the very best, and prompt attention is given to all repairs.

THE BELDEN SYSTEM of arc lighting is described in a neat little pamphlet sent out by the Belden-Larwill Electric and Manufacturing Company, of Fort Wayne, Ind. This company reports a very brisk demand for its lamps and the shops are running to fullest capacity.

THE PERU ELECTRIC MANUFACTURING COMPANY, of Peru, Ind., has issued a large second edition of its new catalogue, and the trade has been supplied. The new book is very handsome in appearance and contains a complete list of insulators, etc., manufactured by this company.

EDWARDS & COMPANY, manufacturing electricians, East 144th street, New York, announce that to accommodate their customers in the Borough of Manhattan they have had their telephone calls changed as follows: Main-line call, "1702 Harlem"; Bronx Borough call, "8 Melrose."

MR. Y. WATANABE, architect, Imperial Japanese Navy, has contracted with the American Bridge Company for the steel work for a foundry, gun and mounting shop for the Kuri Arsenal. The American Bridge Company is also furnishing steel work for the forge shop for the Kuri Arsenal.

THE BILLINGS & SPENCER COMPANY, Hartford, Ct., has issued a new price list of its drop-forged eyebolts, which went into effect on January 1. Both straight-shank and shoulder eyebolts are included in the list, which will be cheerfully sent to interested persons upon application to the company.

THE CUTLER-HAMMER MANUFACTURING COMPANY, of Milwaukee, Wis., has had a very successful year in the manufacture of rheostats, starting boxes, and electric controlling devices. The new iron-clad type of field rheostat is meeting with an unusually brisk demand. Catalogue "2" describes this particular instrument in detail.

THE CUTTER COMPANY, Nineteenth and Hamilton streets, Philadelphia, Pa., has issued a circuit-breaker catalogue describing its extensive line of manufactures. The different types of circuit-breakers are printed on paper of different colors so that reference is easy. The catalogue will be sent free on application to any one interested.

THE VARLEY DUPLEX MAGNET COMPANY, Seventh and Provost streets, Jersey City, N. J., is sending out a very handsome catalogue describing its process of manufacturing the Varley duplex magnets, and giving illustrations and price lists of its extensive line of manufacture. The catalogue is excellently prepared and will be sent free to any address.

THE AMERICAN ELECTRICAL WORKS' western office and warerooms have been removed to 82 Lake street, Chicago, Ill. In the present quarters there is a much larger floor space than in the old location on Madison street, and a large stock of all wires and cables manufactured by the company will be carried. Mr. F. E. Donohoe is the company's western agent.

THE CONTRACT for electrical work for the large apartment hotel being erected for the Onward Construction Company, W. E. D. Stokes, treasurer, at Seventy-third and Seventy-fourth streets and the Boulevard, New York city, has been awarded to Frederick Pearce, 18-20 Rose street, New York city. Mr. Pearce states that this is the largest single contract for electric wiring ever awarded in New York city.

THE AMERICAN BRIDGE COMPANY has grouped all its eastern plants in one section, and has appointed Mr. A. J. Major, formerly manager of the Bridge and Construction Department of the A. & P. Roberts Company, as manager of all these plants, which include the following: The Pencoyd, East Berlin, Buffalo, Edge Moor, Elmira, Groton, Hilton, Horseheads, Trenton, Post & McCord, Rochester, and Union plants.

THE CLAY WORKING and coal mining interests of John T. McRoy, maker of the well-known McRoy conduits, situated at Brazil, Ind., and which he has conducted for the past five years, have been incorporated as the McRoy Clay Works. McRoy conduits will continue to be the principal product manufactured. Hereafter, the headquarters of the company will be Brazil, Ind., with branch offices in Chicago and New York.

CASSIER'S MAGAZINE, beginning with the new year, has put into practical shape an entirely novel idea in magazine make-up—a "library edition" as it has been called. Instead of having the usual paper covers, like all the other magazines, this "library" copy each month hereafter will be available in handsome cloth covers, with gilt lettering, printed on extra heavy paper—constituting in fact a copy *de luxe*. In this form, each separate copy of *Cassier's* will be a substantial volume, likely to have a much more enduring life than that of simply one single month, and certain to prove at once a worthy library acquisition.

COLUMBIA UNIVERSITY, New York city, has a course in which under-graduates learn motor vehicle construction. In adding such a course the faculty say that the motor vehicle has become such a factor in private and commercial use that it is essential that a mechanical engineer should be well posted in its construction as in marine engine building, stationary, or locomotive engineering. Some time ago a similar course in gas, gasoline and oil engines with special reference to their application to motor vehicles, was announced by the International Correspondence Schools of Scranton, Pa., and it is said that the course met with considerable success.

MR. F. W. HORNE, YOKOHAMA, JAPAN (post office box 174), informs the ELECTRICAL REVIEW that he has made important improvements in his building and that the agencies he represents number some 40 leading manufacturers of the United States. Among these are Yale & Towne Manufacturing Company, Rand Drill Company, Hayden & Derby Manufacturing Company, W. F. & John Barnes Company, A. L. Ide & Sons, Atlas Engine Works, J. A. Fay & Egan Company, William Powell Company, Hall Safe Company, Sebastian Lathe Company, Charles A. Schieren Company, Buffalo Forge Company and the Standard Tool Company.

WITH THE BEGINNING of the new century the Sprague Electric Company, of New York city, opened another branch office to facilitate the handling of its constantly increasing business in the South. The new office is located in Baltimore in the Guardian Press Building, on the corner of Calvert and German streets. This office will enable the company to keep in closer touch with the large amount of government work constantly being done, and also to handle more conveniently the increasing demand for its various products throughout the South. The manager of the new office is Mr. W. H. A. Davidson, who goes there from the New York office, where he has been for many years. He has sold Lundell motors ever since they have been on the market.

THE MERRITT AIR BRAKE COMPANY has recently doubled its factory facilities in Brooklyn, N. Y., and increased its financial strength, and is now manufacturing a number of complete equipments daily. While this is a new company in the field it has met with remarkable success. A number of its brakes are installed on the DeKalb avenue line in Brooklyn, the Brooklyn Heights Railway Company, in Brooklyn, the Detroit Electric Railway, in Detroit, the Buffalo Traction Company, in Buffalo, and the Citizens' Traction Company, of Oil City, Pa. The officers of the company are particularly well pleased over the fact that they have not received a single complaint from any of these users, the only trouble arising from the fact that they are not able to supply the additional orders as promptly as desired. The New York offices of the company are at 20 Broad street. Mr. J. C. Gilbert, the vice-president and general manager, is managing the affairs of the company.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, has placed on the market a new type of chloride accumulator especially adapted to the requirements of telegraph, fire and police alarm, laboratory and other service where voltage rather than amperage is desired. This "BT" type, although of identical plate construction with the other sizes of accumulators manufactured by this company, is peculiar in having the positive and negative plates, together with the lugs or connectors cast in one section, forming "couplets," in this way obviating entirely the necessity for bolt connectors or burning to set up the battery. The plates are simply lowered in the receiving jars and the only connections to be made are at the terminals, thus effecting a very considerable saving of labor in installation. The "BT" cell is made in one size only, the plates being four by three and one-sixteenth inches, the discharge in amperes for eight hours being three-quarters of an ampere; for five hours, one ampere, and for three hours, one and one-half amperes. A circular describing these cells will be forwarded upon application to any of the company's offices.

THE EMPIRE STATE EXPRESS train of the New York Central & Hudson River Railroad is the fastest long-distance train in the world. It averages fifty-three and one-third miles per hour for the entire distance from New York to Buffalo, 440 miles, including four stops and twenty-eight slowdowns. It does this each business day of the year, and has done so for several years, and in its flight across the Empire State, this train covers 125 miles of this distance at exactly 60 miles per hour; for stretches of from 10 to 24 miles the train makes the time at the rate of from 61 and 62-100 miles per hour to 64 and 86-100 miles per hour. The train weighs 608,000 pounds and has a capacity of 248 passengers. The attention which the Empire State Express has attracted in every country of the world has proved one of the greatest advertisements for American machinery and American methods that has ever been put forth, and the New York Central & Hudson River Railroad Company is entitled to the thanks of not only the entire state of New York, but of every person in the United States, from one end of the land to the other, for placing before the world such an object lesson.